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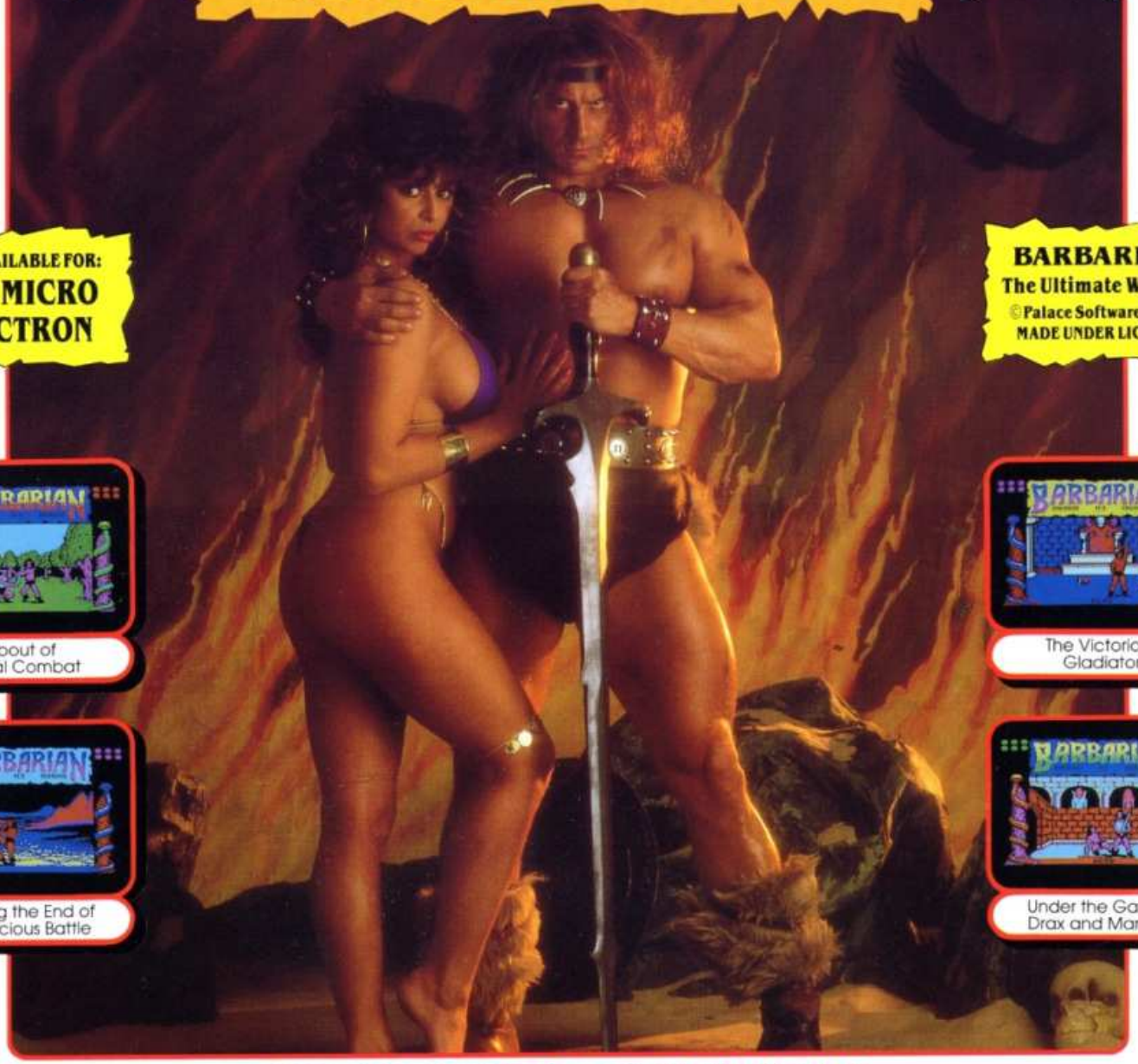

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'ARTROOM is the software for you.' A & B Jan '87

ACE consists of two programs. COLOURIZER enables you to produce MODE 1 colour versions of ARTROOM screens and to dump them to a printer using a shaded printer dump. The MODE CONVERTER program will convert any graphics screen into a Mode 4 ARTROOM screen ready for loading into ARTROOM. Conversions can be made from Modes 0,1,2,5 and 7. yes SEVEN!

'...very pleased with the way Clares have introduced the colour facility.' A & B June '87.

ARTROOM and ACE will work with any mouse but we recommend DIGIMOUSE because it is well engineered using a non-slip ball and optical encoders. DIGIMOUSE also includes the unique 'LINEAR LOCK' facility that enables you to draw straight lines freehand.

'...impressed by Nidd Valley Digimouse' A & B June '87

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'We use Beta-Base ourselves' Mike Bibby, Editor of MICRO USER.

'Rated best value for money'—ACORN USER Dec '84

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'an ingenious collection of utilities...' BEEBUG Oct '86

'worth its weight in gold.' A & B Jan '87

MACROM is a fast full featured MACRO ASSEMBLER that allows the use of macros, which are loaded from disc. MACROM has its own easy to use editor which automatically formats your source code. A HI version of MACROM is supplied for use with the second processor. A macro library and demonstrations are also supplied.

'Full marks for an excellent product.'—BEEBUG JUNE 1986

We are also making BROM+ available under this offer. Its main feature is the full scrolling BASIC editor which allows the user to edit a program as if dealing with text in a wordprocessor. There are many other features dedicated to making life easier for BASIC programmers.

'This is the best BASIC screen editor I have so far used.' —MICRO USER August 85

For BROM+ add £25 on ROM, £20 for 5.25 inch disc or £22 for 3.5 inch disc.

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FONTWISE+ is compatible with WORDWISE, VIEW, INTERWORD, MINI OFFICE II and EDWORD II.

'FONTWISE is better than many NLQ packages'—ACORN USER Sept '86

The FONT EDITOR is very easy to use and allows you to edit the current fonts or create new ones. Reviewers have praised the editor for its ease of use and faultless presentation.

'editor is impressively quick, smooth and easy to use'—A & B

EDITOR '...puts all previous designers to shame.'—BEEBUG July '86

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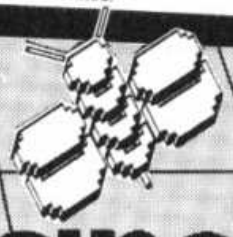

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A&B COMPUTING

Volume Five Number Eight August 1988

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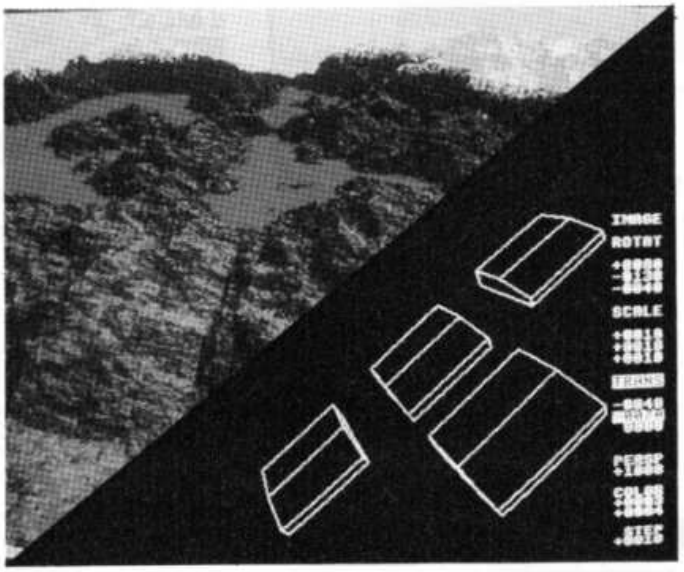
GRAPHICS SPECIAL

Dot Matrix Magic 1 14
Snatch from 4Mation answers all those muttered prayers for the ultimate printer dump.

Dot Matrix Magic 2 18
Master owners can take advantage of extra memory and graphics features with Clare's Artroom

Real Time Graphics 74
These animated three dimensional images impress the hell out of our reviewer.

RGB Rainbows 85
We've estimated you can achieve over 50 million colours with this simple RGB colour mixer project



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Let your BBC take the strain!

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Control in the Classroom

Master 512 roundup

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Pipedream review
CMOS RAM editor
UNIX developments
Desktop diary utilities
ROM Podule
Adding a 5¼" drive
+ Adventures
+ Arcade
+ News

Archimedes
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Alpha-Base is the successor to **Beta-Base**, the top selling database for the BBC micro. Alpha-Base really does '**HARNESS THE POWER**' of the Archimedes. As with all Clares products we have made **Alpha-Base** powerful but easy to use. You can be using a database within 5 minutes of receiving the program - that's easy. But don't be fooled, you do not lose any functions or power. Here are just some of the functions:

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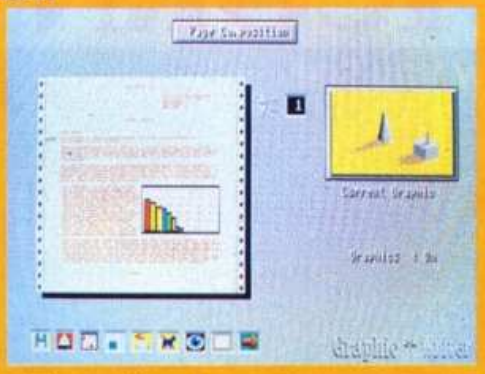

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* Graphics editor
* Page format controls page length, headers, footers, pad and pound characters.
* Page Composition allows placing of graphics, mini preview etc
* Multiple print out options
* Auto page numbering even through multiple documents

To create a document with **Graphic Writer** you type in your text, using the many text styles available, leave room for the graphics and then place the graphics using Page Composition. It's simple and easy to use. You can have up to 14 documents in memory on a 310, that's equivalent to about 220 pages of A4 text.

See what the magazines say:

> the scrollling is unbelievably smooth... I can highly recommend this excellent product as being **THE** word processor for the Archimedes
>
> *MICRO USER April 1988*

> excellent value... bowled over by its stunning use of graphics.
>
> *RISC USER December 1987*

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Thunderbirds are Go!

Good News from Grand Slam Entertainments. International Rescue are to be tranformed into a game for the Arc (oh, and a few other formats as well). *Thunderbirds – the Game* (not to be confused with the B.T. effort of a few years ago) should be released in the Autumn.

In the meantime Grand Slams' smash hit *Terramex* – the only game to get 10 out of 10 in Your Commodore magazine should hit the streets very soon closely followed by the Hunt for Red October – a strategic sub hunt simulation and the Flintstones – a prehistoric bowling game. Nice to see a quality games company taking the Arc seriously.

On the 8-bit front Grand Slam have acquired Domarks' back catalogue which include quite a large number of Beeb hits retailing for a mere £1.99 each. Furthermore the idea of converting some of these titles onto the Arc has not yet been dismissed.

ACORN NEWS

Now You See It....

An interesting new bulletin board service for Beeb users is online now. Called **Phantom Viewdata**, the sysop is Keith Burton and the service is fun!

Using simple Prestel type screens and using any modem that supports Prestel, you can access the pages of this non-profit making service by simply dialling 0226 732 140.

The service is sponsored by funding and advertising, so if you have anything you want to sell, perhaps a quick and easy way of doing this is to give them a ring and find out some more.

● Contact them on Prestel MBX:919998422, Telex 934999 TXLINK G Quote Ref: MBX 919998422.

Poetic Justice

The wacky, hip hop princess royal, hosted a royal gala dinner held last month at the Holiday Inn, Cardiff, to raise funds for the British Olympic appeal in Wales – the event proved to be sumptuous in the extreme and the event raised over 56,000.

The point is that an Archimedes – donated by Acorn was put up for auction at the gala – it raised a lot of money, the Olympic appeal was bumped up a bit by the Archie and everybody was happy.

Fast Sorting For Wordwise

IFEL have just released a clever little sorting package for the the BBC Micro using Wordwise Plus II as the front end processor. Designed for use with the famous word processor, it can sort paragraphs, single lines in ascending or descending order either by letter or number, it can even sort on the surname. IFEL tell me that this is very fast – it can sort 100 addresses in less than a second. Likewise 400 addresses take between 4½ and 6 seconds depending on the options selected.

Contact IFEL at: 36 Upland Drive, Plymouth, Devon, PL6 6BD ☎ (07555) 2286.

Just who are these Warholas guys anyway?

Novelty item this month – following on from our music ish in June (the answers and winners are in the Back Page), I found out that a 12" single entitled **Pop Art's Dead** was released about the time of our magazine's release by a band that uses the UMI 2B system for composing with.

And no, Vince Clarke isn't in the band!

The Warholas are, quite simply, a "pop" group with a difference – their music is pretty good, it sounds even better on my Linn turntable (we're obviously paying you too much – Ed), and you can clearly hear the BBC Micro being used for some of the musical twiddly bits.

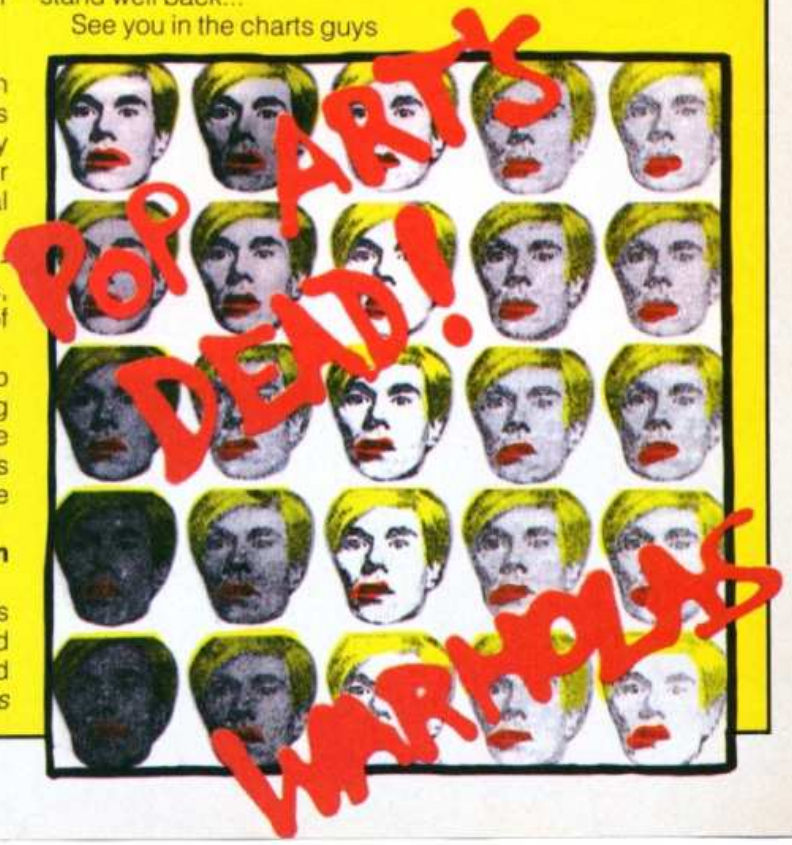
After having a chat with lead singer J.C. Superstore, he very kindly offered 13 limited edition posters, signed by *Sturtz*, the artist behind the transferring of Andy Warhol's ideas onto poster format.

Each poster is individual in its own right – and no more of these can ever be made as the ceiling collapsed in on the screens used for printing these wonderful posters during the height of the band's celebrations after releasing the single, ahhh, you've done old Andy proud there chaps.

The question is: **How many members are there in the Warholas?**

If you want to hear what the sounds on the Warholas single are like, just walk into your local record emporium, put on some loon pants and a kaftan and say *"hey, maan... have you got the crazy new vibes from the Warholas?"*, give the nice gentleman the label and catalogue number, (Pirahna records and pirahna 1) and some money, light the blue touch paper and stand well back...

See you in the charts guys



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BEEBUG

The magazine is now in its sixth year of publication with 20,000 subscribers throughout the world. Its proven format has been invaluable to serious BBC Micro and Master computer users in the home, education and business.

Each issue of BEEBUG provides 72 pages of articles, programs (utilities, applications etc), tutorials, workshops, reviews, hints & tips, news and information to beginners and experts alike. All our programs are tested on all versions of the BBC Micro, and are also available monthly on disc or tape.

RISC USER

This is the magazine for anyone interested in Acorn's RISC computer, the Archimedes. Launched at the same time as Archimedes, RISC User provides lively and informed coverage of what's happening in the world of Archimedes.

Reviews, hints, programs and articles are all specifically written for Archimedes, showing how to exploit the many features of this sophisticated computer. RISC User is all about the Archimedes, it does not contain modified programs originally intended for the Model B or Master.

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BEEBUG – The Archimedes Specialists

Acorn User Show Cancelled

News went round at the May Micro User show that the annual Acorn User show, traditionally held at the end of July, has been cancelled. A&B Computing's exhibitions organiser, Sue Pritchard, confirmed the rumour.

Companies at the New Horticultural Halls based Micro User show said they were stunned and reported that staff at Redwood, publishers of Acorn User, were very disappointed. Acorn are known to be interested in holding a "professional" show to support the Archimedes and Acorn's new dealer network.

Too Little Too Late

Yes folks, it had to happen after some time or another. Tempo Systems, a Public Domain Software Group (PDSG) have decided to set up a PD software library for the BBC Micro.

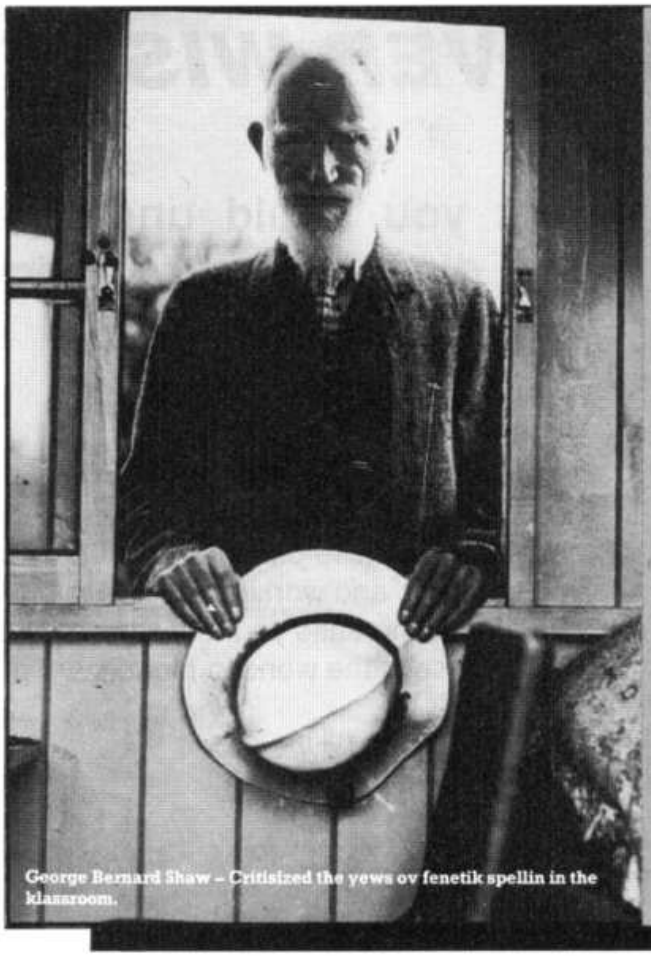
As usual, the concept of a PD user group for the Beeb is about three years too late – but there is an awful lot of software out there, and there are a lot of good programs written for the BBC B and the the Master.

If you are a programmer and have written a package or a program you would like to see on the PD library and would like to find out more, then contect them at:

BBC Public Domain Software Group c/o Tempo Systems, Apollo Walk, Portrush BT56 3AB

Again, it may be too little, too late, but if the interest is there, then a BBC PD library will take off like a rocket.

Good luck chaps.



George Bernard Shaw – Critisized the yews ov fenetik spellin in the klassroom.

The great Phonics Debacle

An extremely dodgy form of teaching words called *Phonics* was thankfully abandoned just before I started English at school. The general idea was that you were taught the sound of a word before you actually learned the spelling of the word, this meant that you had to learn words twice – a luxury not many of us can afford.

Why do I call it dodgy?

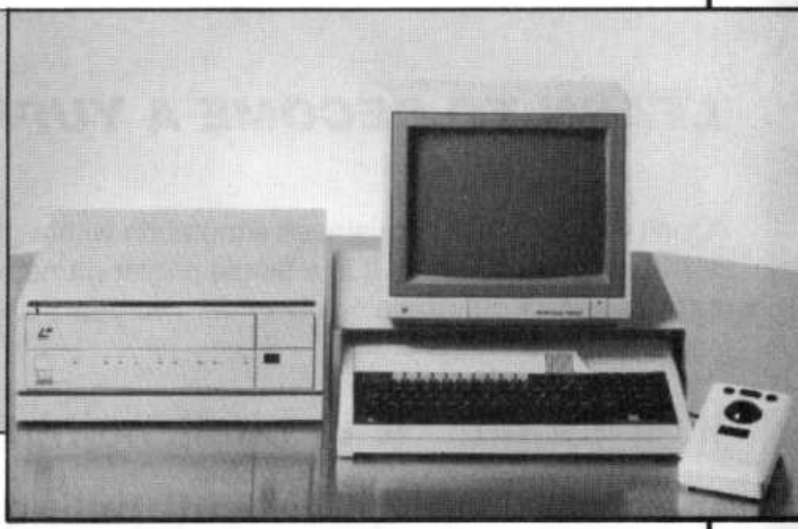
Because Phonics are a waste of time at a very early age – they may work for adult illiterates who understand *words* but not the spelling.

Which is why I am a bit worried about the release of *Letters and Pictures* from Chalk Soft. This package uses Phonics throughout to supposedly teach word building skills but before I worked at A&B I did a little work at a remedial teaching school and our general experience was that *Phonics just do not work* although I don't mind being proved wrong.

The ball is in your court Chalk Soft.

BBC Interactive Video

Gloucester College of Agriculture and Horticulture is to produce an AIV training programme to meet the requirements of the Level 1 Horticulture curriculum. Release is scheduled for the autumn. The video disc will run on BBC and Domesday systems.



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Publisher Performs

PMS have launched their Publisher "fontware". The 64K PALPROM-based software provides matching screen and printer typefaces for all the popular wordprocessors. Typefaces, sizes, line drawing, boxes, tabs, page layout, inverse and grey shading effects are all generated by *escape code* sequences. Screen preview and printed page are uncannily similar. PMS can supply over 50 fonts; 16 appear in the Publisher with others available in ROM or on disc.

Price £39.00 + VAT. Details from PMS, 38 Mount Cameron Drive, East Kilbride, G74 2ES. ☎ 03552 32796. Upgrades are available for users of PMS' Multi-font NTQ software.

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Order from: RBRC SOFTWARE, The Guild House, 32 Worple Road, Wimbledon, SW19 4EF
Telephone: 01-946 8641.
please state whether RML "Nimbus" or BBC/B or Master.

Premier Dealer Award for Watford Electronics

Panasonic's Mr Harry Kurokawa and Mr Len Carlton recently presented Mr Nazir Jessa, MD of Watford Electronics, with their top dealer award.

Eighteen months ago, when Panasonic announced their printer range, Mr Jessa "saw a good product and a company which would provide the kind of support we need in order to give the best possible service to our own customers. I acted quickly, contacted Panasonic and haven't looked back since".

Dealer Conference

Acorn held its first series of dealer conferences around the country during May and June, starting off in Cambridge where some 50 delegates attended.

In addressing the audience, Harvey Coleman, Acorn's managing director, outline the company's plans and marketing strategy.

Ian Laurence, sales and marketing director at Acorn, highlighted some of the new target markets for the Archimedes range. Details of further support services, such as training courses and the SID online information database.

EdSoft Consortium

An interesting new consortium of educational software publishers has been formed by Cambridgeshire Software House, 4Mation, LTS and Sherston Software. Called Judgevalid Limited, from LEA's point of view the main significance lies in the fact that they offer a discount service whereby orders can be placed for any combination of their collective titles – minimum order is 50 copies. For schools the most exciting part of the venture is KEY IDEAS, a FREE magazine which will be sent to every infant, junior and primary school in the country – the first issue was circulated in May – and will provide some stimulating ideas and information concerning the use of computers in schools. Initially the magazine will be published on a termly basis, and the members of the consortium – it has an interesting range of information from many other sources – hope that it will become THE forum for exchange of news and views in the primary micro field.

Further information on the consortium and KEY IDEAS from KEY IDEAS, PO Box 2, Inkberrow, Worcs WR7 4JY or any of the four software houses concerned.

PC update

***PC Telesoftware* is now available on the BBC's CEEFAX service.**

Since April 15, BBC Telesoftware has broadcast a regular service offering software for the IBM PC and similar systems. With a "teletext adaptor" card fitted to your PC, you can, at the press of a button, receive and save the files Ceefax will be broadcasting, just like on your BBC Micro. You will also be able to receive CEEFAX on your PC's screen. Details on CEEFAX page 700.

***Olivetti* have launched the *PC1* in the UK. The machine is priced from £399 for the single 3.5" floppy drive/monochrome monitor version. Colour monitor and twin floppy systems are also available through Dixons, who currently have an exclusive on sales.**

P748 CEEFAX 222 Mon 4 Apr
1/2
IBM PC
Telesoftware is expanding ...
Starting April 15, BBC Telesoftware begins a regular service offering software for the IBM pc and similar systems.
Each week there will be new programs for you to use and keep. With a "teletext adaptor" card fitted to your pc, you can, at the press of a button, receive and save the files we will be broadcasting. You will also be able to receive CEEFAX on your pc's screen.
Receiving Telesoftware 715

Archimedes IMPULSE
New Archimedes Operating System but it means delay for wordprocessor and drawing programs

Computer Concepts have announced the ongoing development of a completely new operating system for ARM based computers. Developed primarily to provide a base for future Archimedes based products, CC say that "this operating system considerably extends the capabilities of the machine".

Features will include:

- Multiple applications running together in the machine at the same time and multiple copies of the same program.
- Multitasking.
- Advanced memory management to provide a good range of heap and memory allocation functions and physical memory protection for tasks.
- PostScript (TM) compatible graphics.
- Solid windows created by combining ARM power and the Postscript (TM) like graphics primitives.
- ADFS file compatible filing systems.
- Multiple processor support designed to cater for future parallel processing.

Computer Concepts intend IMPULSE, as the OS is to be called, to be ready at the end of 1988. Computer Concepts' already announced wordprocessor and drawing program will be released as Arthur (the Acorn operating system) compatible versions first but users will be able to upgrade to the (superior?) IMPULSE versions once available.

Two further products for the Arc from CC are Spellmaster (£59 inclusive) and Fax Pack. The facsimile add-ons for Archimedes are threefold: pack 1 includes modem and software (£499+VAT), pack 2 adds a 200 dots per inch scanner (£799+VAT) and pack 3 includes a flat bed 300 dots per inch grey scale document scanner (price will be announced in the region of £1100+VAT).

You will also be able to buy Spellmaster for the Cambridge Z88 portable, anticipated release this month.

This month we have no less than three packages for the BBC Micro and the Archimedes up for grabs for our competition.

- Arctist
- Artisan
- Realtime Graphics' 3D solids modeller
- Nidd Valley Digimouse (compatible with Watford's Quest Mouse and AMX Art etc...)

All we are asking of you this month is to send us an illustration (either hand drawn, or on computer) of the range of Acorn Micros - be they as technical drawings or as fully blown paintings.

By just selecting the prize **you** would like to win and enclosing the coupon along with this competition form, you could win one of these super packages!

So get drawing . . .

Competition Time!

Name .....

Address .....

.....

.....

Postcode .....

I would like to win the:

- ☐ **Arctist Package for the Archimedes**
- ☐ **Artisan Package for the Archimedes**
- ☐ **Nidd Valley Digimouse for the BBC Micro**
- ☐ **Silicon Visions 3D Graphics package for the BBC Micro**

Because .....

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All entries for the graphics competition are to be sent to:
Graphics Competiton, A&B Computing,
No 1 Golden Square, London, W1R 3AB.

- *Photocopies will* ***not*** *be accepted*

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128k SILICON Spelling Checker

One of the most successful products ever on the BBC machine, this is now available on a single chip, for the Archimedes and soon for the Z88.

All versions of SPELLMASTER offer instant spelling and typing checking – as you type. The single chip contains almost 60,000 English words and user created dictionaries can extend this number.

A range of dictionary search utilities are provided, in all versions, that rapidly search the entire dictionary and enable any of the following to be found;

1) Words that sound like the one specified.
2) Words that are spelt approximately like the one specified. This is ideal for correcting typing errors where words have a pair of letters transposed, one letter wrong, missing, or one too many.
3) Words where only a few characters are specified, (solves crosswords).
4) Words that have the correct letters, but are mixed up, (solves anagrams).

All these search facilities are accessible from any program that can issue star (*) commands.

In addition there are facilities to check text directly within a variety of text editors or word processors, to check the word at the cursor, to check all text from a specified point, or to just browse through the dictionary.

The BBC SPELLMASTER can check-as-you-type in INTER-WORD, WORDWISE, and VIEW, in all versions of the BBC Micro. The Archimedes version can check-as-you-type in INTER-WORD, is compatible with ArcWriter files and requires a ROM expansion board.

SPELLMASTER for the Z88 is compatible with Pipedream files and contains its own powerful text editor.

Full details on request.

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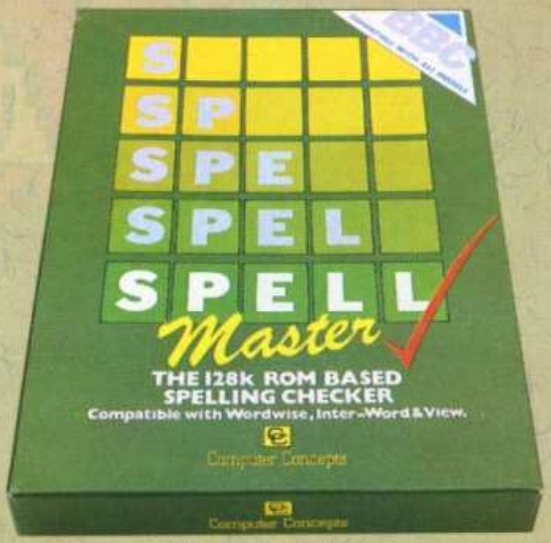

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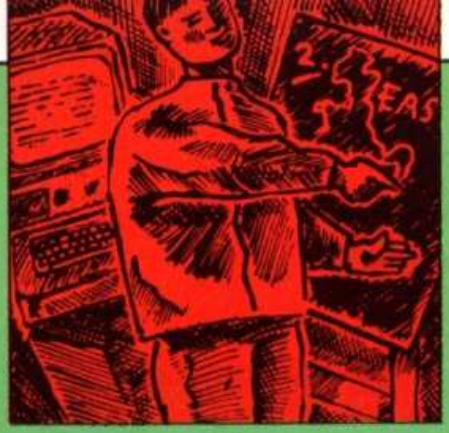


SNATCH answers your printer problems

DOT MATRIX MAGIC

Des Thomas

There have been a number of occasions since I started using computers when I've thought, "If only the program could do this...or that". The first occasion I recall involved using ASK's *Facemaker* – if only the children could dump out the faces they'd created to make a Rogues' Gallery! I pestered ASK – and ESM when they took over ASK's software – for several years, then I discovered Vine Micro's *Replay* which, linked with Computer Concepts' *Printmaster* gave me a tonal dump. Earlier this year ESM came up with their *Screenprint ROM*. A touch on <CTRL P> gives an exact printout, while <SHIFT + CTRL & P> gives an inverted printout. Certainly rogues' galleries are literally child's play with this, but being a ROM you are limited to using it in one machine.

Having loaded *Snatch* into Sideways RAM and selected the options (Fig.1), you simply load your programs as normal and the dump/snatch options are available until the machine is turned off. Of course, this means you can load the program into any number of machines at the beginning of the day, which will be particularly useful in schools, besides being a lot cheaper than a lot of ROMs. 4Mation do not claim that it will work with every program, but to-date I've failed with only one. That was one of HS Software's heavily animated graphic screens. Considering that in one of the earliest reviews I wrote for A & B I likened HS's graphics to those in an arcade game, it's not surprising, because the handbook states quite clearly "Most educational software will tolerate this intrusion but the majority of arcade games will either refuse to co-operate or will crash". It works successfully in all modes, including Sherston's split mode screens, but more of that later!

Fig.1 Options available from title screen

Of course, we're never satisfied for long in this game are we, and other "if only" comments soon start to flow: if only I could make a smaller copy and print it where I want it on the page – (not everyone has access to a photocopier with reduction facilities), select the area I want to print, change the screen colours, save the screen to use, enlarge that bit of the screen, dump to a colour printer or take full advantage of a 24 pin printer...! Well, now you can using one of the most user-friendly utilities you could wish to come across.

Publishers often make bold claims, eg "No school can afford to be without this program". Having had access to several parts of *Snatch* for some time, I can honestly state that it's already becoming one of my most used utility, and anyone wanting to extend the use of their printer will find this bargain disc a real boon. It works with Epson compatible nine and 24 pin printers and the Integrex Colourjet 132. The program is loaded from disc into Sideways RAM, so it runs on a Model B+ (128k), Master or Compact, while on a Model B or B+ (64k) you need a Sideways RAM chip/ board.

There isn't enough room in RAM to have all three versions available together, so the default option is for Epson nine pin printers – FX, LX and MX ranges – plus Integrex. Should you wish to reconfigure it to work with a 24 pin printer, eg Epson LQ range, plus Integrex, it's a simple matter of typing *Eps24 before auto-ooting the program. This only needs to be done the first time you load the program or if you wish to change back then *EPS9 returns it.

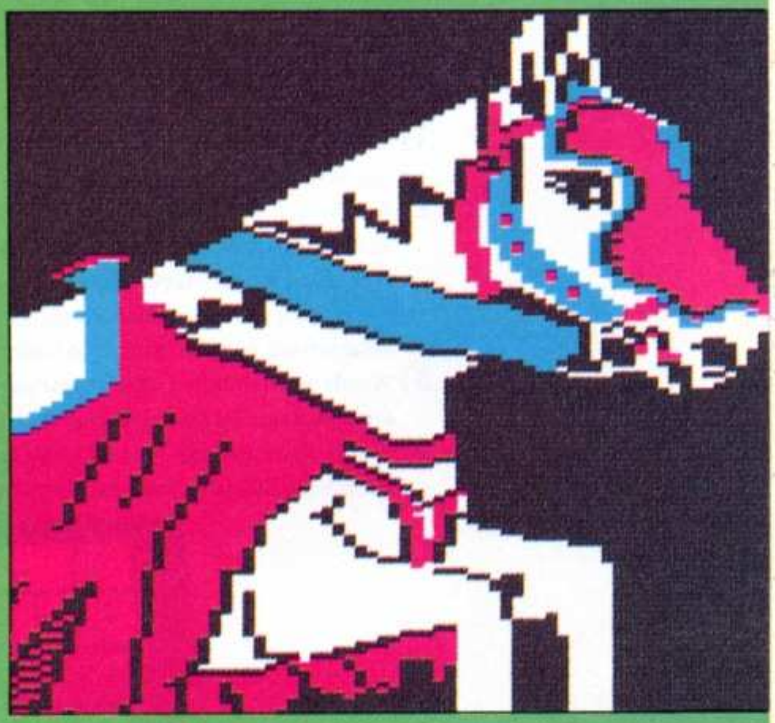


Fig.5 An excellent example of the ENLARGE facility to make book illustrations.

Snatching Screens to Disc

There are going to be occasions when you might want to save screens to disc, eg for batch printing later or screen display, or to

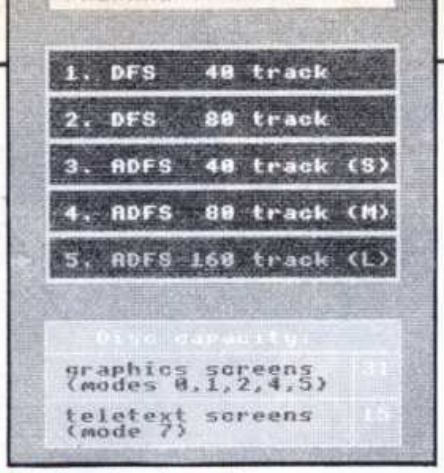

1. DFS 40 track
2. DFS 80 track
3. ADFS 40 track (S)
4. ADFS 80 track (M)
5. ADFS 160 track (L)
graphics screens (modes 0,1,2,4,5)
teletext screens (mode 7)

Fig.2 Preparing a Screen disc

use in programs such as MESU's *Windows*. To use the Snatch option first you need to create a Screens disc. This can use DFS or ADFS and cleverly you can save to an ADFS Screens disc even if the disc you're snatching from is DFS. This is quite an advantage as an 80 track double-sided disc using ADFS can hold up to 31 graphic screens (plus 15 teletext), while a 40 track DFS holds only four (plus 19 teletext)! There's a drive choice for those with double/dual drives and if the disc is full an error message is given. All this is available by typing *SNATCH, which gives a two-option menu: prepare disc (Fig.2) or display screens (Fig.3). The latter even tells you which mode the screen is in.

Having saved the screen to disc <CTRL +SHIFT+X>, it can be reloaded and printed out as below, while the Display Screen mode enables you to view one screen at a time or cycle through all the screens with a set delay. The latter will be useful for displaying screens of children's work on parents' evenings or samples from software at exhibitions. This option also allows all screens to be wiped or one at a time, with a Restore facility if any are wiped accidentally!

The piece de resistance in this section to my mind is the enlarge option for graphic screens. Take any "in use", ie saved, screen and select ENLARGE (Fig. 3). The screen will be loaded and a box will appear in the middle of the screen. This box is positioned using the cursor keys and TAB, and when it is over the desired area – not more than a quarter of the screen's area – by pressing <RETURN> that portion of the screen will be enlarged. To enlarge again press <COPY>.

The power of this is demonstrated in Fig.4a-c. Note the left hand corner of the border between the graphics area and the palette (Fig.4a) in this screen from 4Mation's *World Without Words*. A small area of this has been taken and put through the enlarging process three times (Fig.4b). This was then saved and loaded into a graphics package (same mode required or, if necessary a mode converter) which in this case was Watford Electronic's *Quest Paint* to smooth out the pixels (Fig.4c). From the point of view of making use of this facility for illustrating booklets the horse (Fig.5) from the title page of RESOURCE's *Fairy Lands* provides an excellent example.

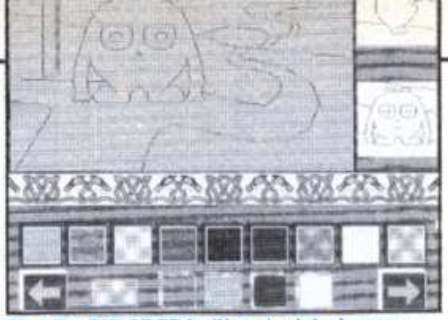
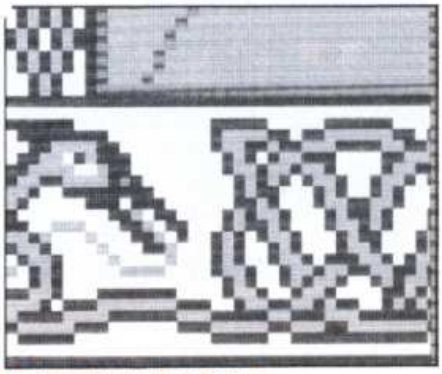
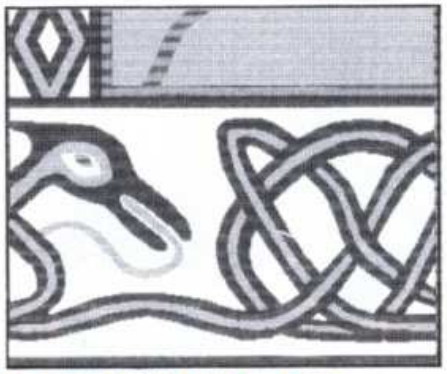


Fig.4 The ENLARGE facility: a) original screen



b) piece enlarged three times



c) same piece edited using Quest Paint

Dumping to a Printer

When you wish to print out the screen which you have SNATCHed or simply have displayed while running a program all you have to do is press <CRTL+ SHIFT+E or I> (E for Epson, I for Integrex) followed by <L> or <S> (large or small). The large option is available on all printers in all modes, but the small option for Mode7 works only on the Integrex. With a little experience you'll soon realise that there are certain colour combinations which work well on screen, but when printed out tonally on an Epson or even in colour on an Integrex are not as good. Prize example of this, I suppose, is the dark blue which invariably prints out as a purple on the Integrex, which is not the best colour for sea and sky.

By pressing one of the numeric or function keys – which ones depend on the mode in use – any of these colours can be changed to any other. At the end of the printout the screen automatically reverts to normal colours, while <ESCAPE> enables you to stop the process at anytime. So by pressing just a few keys you can print out virtually any screen to provide a hard copy of all those delightful pictures from adven- tures, for example, to illustrate your work- cards or the children's own adventures (Fig.6a).

Want just a piece of the screen – that terrifying picture of the dragon or the gentle giant? No problem! Having changed any of the colours required, you simply use the cursor keys and TAB to move the box, which is accurate to single pixel resolution, until it surrounds the area you want. Then this is printed out as above (Fig.6b). Even in Mode7 you can

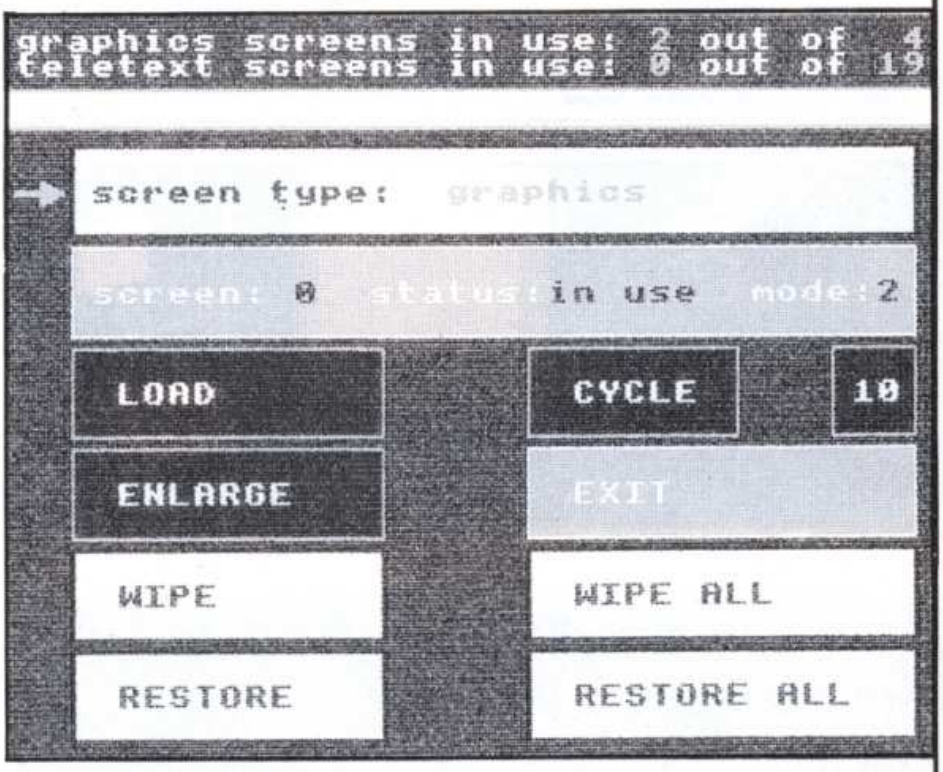


Fig.3 The display screens options

choose the top and bottom starting positions and also change the screen colours.

Another option which is going to be very useful for desk-top publishing (or simply to save paper!) is the one which permits you to decide on the position of small printouts – right, centre or left of the paper.

Split Mode Screens

To-date I've never been successful in dumping split mode screens – *Replay* doesn't like them and neither does *Screenprint*. *Snatch* won't dump them direct from the program, but it has another clever facility available using a SNATCHed screen. This is usually saved in the text mode, but the program then allows you to load the screen in a different mode, eg MODE1 into MODE2 or MODE4 into MODE5, and change the colours. When the graphics portion of the screen is satisfactory you can print that part of the screen as described above. Should you need the text then reload the screen in the text mode and printout that part. Fig.7 shows a split mode screen dumped from Sherston's *The Worst Witch*.

Fig.6 a) The original screen

b) Selective copying and colour changes

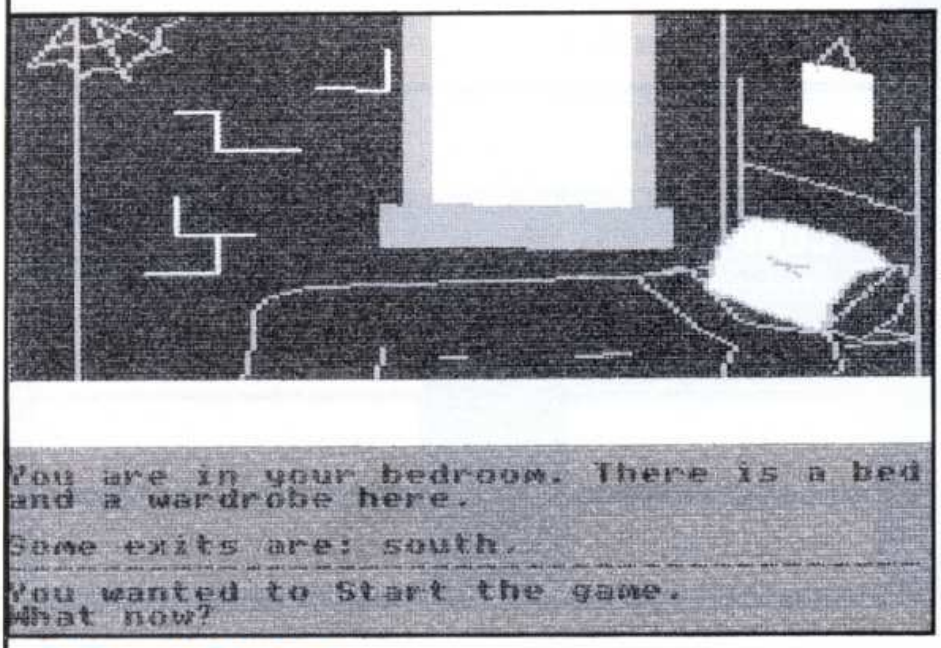


Fig.7 Dumping a split mode screen.

Conclusions

At this point I think I'd better admit several of the above "if only" remarks were originated by me and directed at Mike Matson of 4Mation. Mike helped me early last year with a program which enabled me to dump screens to an Integrex printer using Vine Micro's *Replay* (In the Print 3 – June 1987) and again when I wanted a colour dump put into RESOURCE's *Fairy Tales* (April 1988) he came up trumps. As a result he's had to put up with many cryptic phone calls since. No doubt he's hoping *Snatch* will get me off his back and let him set up his next adventure. Well, he's safe – for a while anyway – because this package even includes at least one of my more tongue-in-cheek suggestions.

I know of no other package that comes anywhere near *SNATCH* in providing the printer facilities I require for nine and 24 pin printers as well as the Integrex. If it satisfies my needs – I imagine I use these more than most in creating illustrations for my articles, personal use and in school – then I feel very confident in recommending it to schools and anyone else who wishes to use a printer in a creative way. At around £15.00, it's likely to be one of the bargains of 1988. 4Mation expect it to be marketed in September, so watch the adverts or write to them and book your copy now – there could be a waiting list!!

Factfile

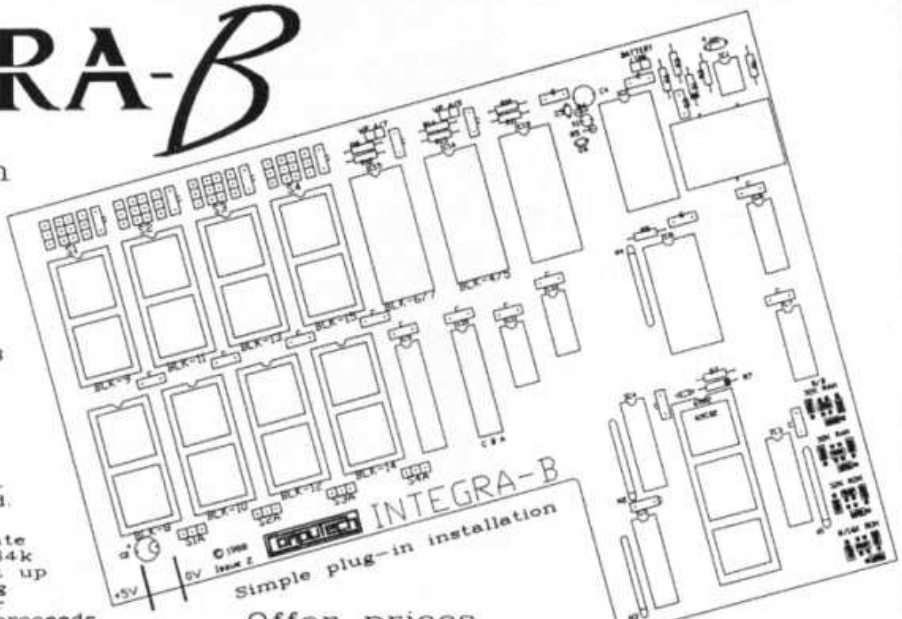
Snatch is available from 4Mation Educational Resources, Linden Lea, Rock Park, Barnstaple, Devon EX32 9AQ ☎ (0271 45566)

INTEGRA-B

The Expansion

for the

BBC Model B



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1. All standard expansions included on one board.
2. 64k battery-backed Sideways RAM included.
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Additionally, part of a Private RAM block (8k), or 16k to 64k of Sideways RAM can be set up as a printer buffer, allowing concurrent work on another application whilst printing proceeds.

Includes the INTEGRA-B OS ROM giving an extended set of commands and utilities handling all of the system management. Allows you to keep multiple startup configuration files on disc.

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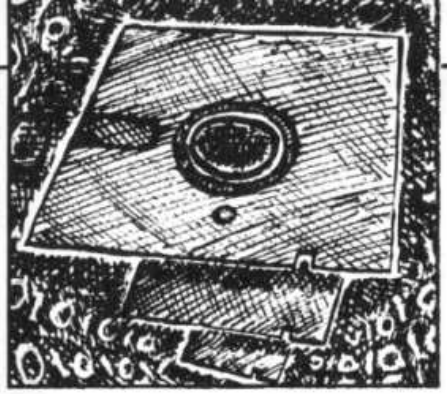


Master Compact owners are lucky in having a graphics package written especially for them. Fonts and fills at your finger tips and the facility to be creative with *Clares*

DOT MATRIX MAGIC 2

Kenneth John

Entering the Room

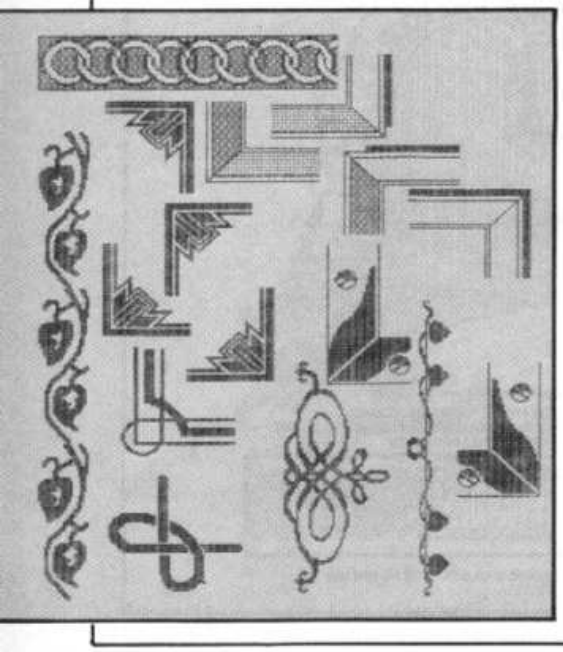
Artroom is provided on disc which, when loaded with the usual ***MOUNT** and **!BOOT**, provides one with a message indicating two options in, according to the manual, the following form:–

1) LOAD &INITIALISE ARTROOM
2) PRINTER DUMPS

Don't hold your breath waiting for these to show. What in fact one sees are two icons back to back, one representing a printer, though it took me some time to decipher it, the other half, what I now believe to be a paint pot and artists brush. By depressing the <Space bar> one or other of these icons, to use the word from the instruction book, is "highlighted". In practice one is black the other white and the black one is selected as your choice. Once grasped, the operation is quick and effective.

On choosing the icon which equates to *LOAD & INITIALISE ARTROOM*, the program is loaded into sideways RAM and initialised ready to run. While in sideways RAM, as long as you do not switch your computer off or overwrite the sideways RAM, Artroom can be initialised at any time after pressing a <CTRL-BREAK>. *ART-ROOM <Return> re-enters the program.

If you do not possess a mouse do not despair. Although the the use of a mouse is strongly recommended, and in particular a Clares' mouse, it is not essential. After practice I found a mouse to be faster and much easier than the keyboard, particularly with non-straight line aplications. The mouse must be of the three button species, and wired to Acorn/Olivetti standard.



First Impressionisms

First impressions of the package were favourable. I read the manual through without recourse to the software, and understood it. Having put it together in the form of general introductons, a tutorial in the shape of a guided tour, an 'iconic index', sections dealing with printer, ADFS tips, and finally a section on hints and possible problems, the authors nearly succeeded in making the manual understandable and friendly. It was though, early days for claiming complete user friendliness as I was to find out.

Familiarisation

Taking the guided tour is by far the best way to get to know Artroom. Taking an occasional detour does not cause havoc, and despite the authors' confidence in other's skills, at the end of the day artist's licence salves the conscience.

Icons on screen are easilly recognisable, though *Sad Face* and *Happy Face* required a hard stare initially to differentiate. This is where the index came in handy. Most of the icons can be placed though some what loosely, into one of three groups, which I will call artwork, adapt and utility.

Nine icons make up the first group. There are Fills, Fonts, Airbrush, Pens, Boxes of various density and with or without border, Circle, Rubber-band, Zoom and Inverse.

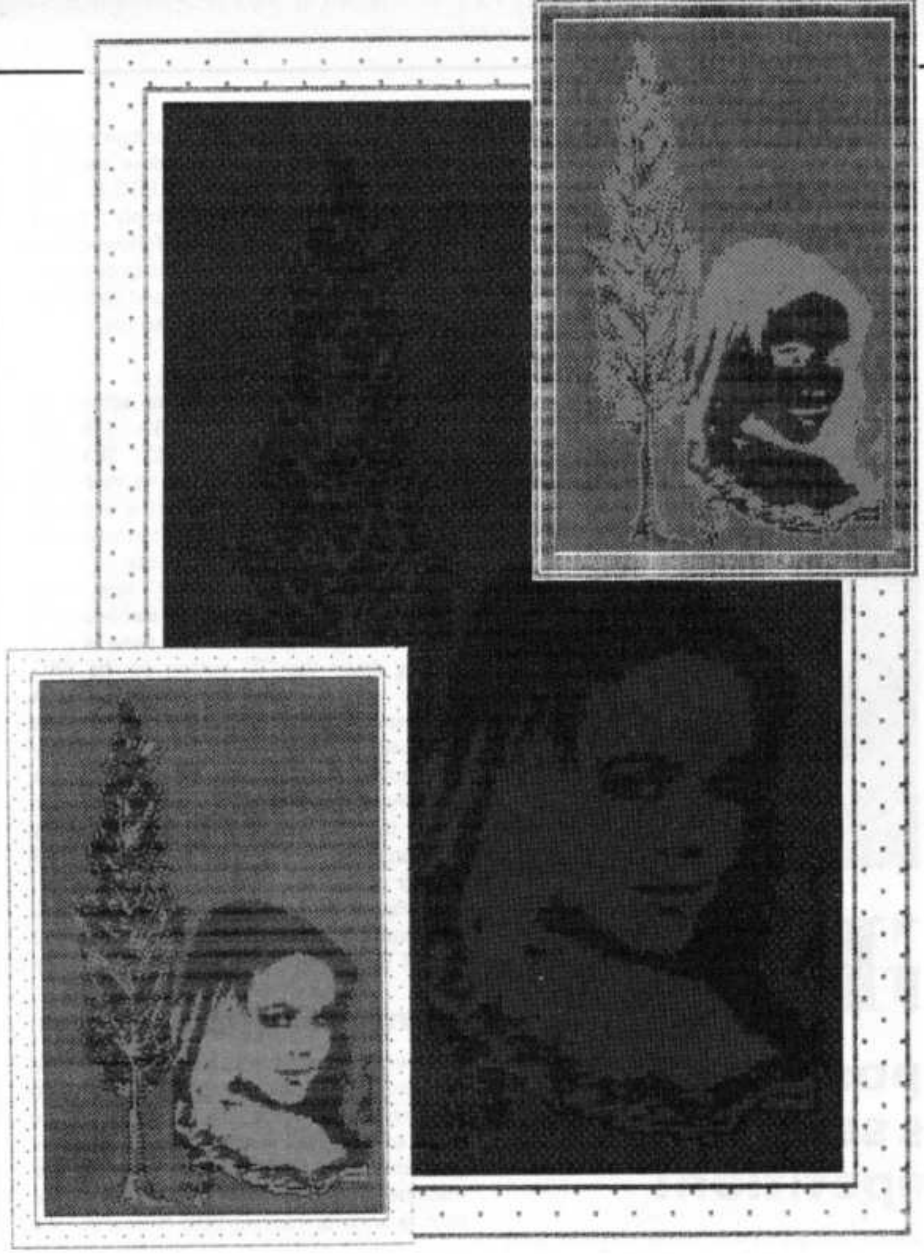
In the *adapt* group are four icons which enable one to change the size and position of the artwork on the screen. In this group I have placed Copy/enlarge and Copy/reduce, which provide both a cut and paste facility and can be used for the overlay of a graphic on to an existing image without erasing the latter. This is an example which demonstrates why the functions should not be thought of as belonging solely to one grouping. It is fairly obvious cut and paste is creative. Also in adapt is Mirror, left/right, up/down, an operation which is used along with the copy icons.

In the utility group fall Load from and to disc, both of which have useful additional functions. These have clear explanations in the guide but it is worth saying at this point, having a formatted user disc to hand can save time and trouble later on. As one would expect files from the program disc and the user disc can be accessed when required. A part or whole screen can be saved. An understanding of ADFS is required, and the manual goes to considerable length to explain the ins and outs of the system in, as one would expect, the context of Artroom. No bad thing in my opinion.

Keep Smiling

Faces, Happy and Sad!, are icons in the utility group. Happy Face allows you to save a work screen to a reserve screen. Sad Face lets you restore the reserve screen to the current screen. In other words if you make a mistake, or are not satisfied with what you have produced, going to Sad Face icon will return you to the stage when you last stored to reserve screen.

I found myself using Happy Face quite frequently once I realised that a mistake could put the whole process back several stages if the store facility had not been used. It is quite easy to become absorbed and abandoned to your creative zeal, which takes quite a blow if by some freak chance your skill should forsake you. You are then forced



Enlarged, reversed and normal screen dumps are possible using this package.

to attempt, in vain most likely, a repeat performance. Be advised! Make use of this very necessary facility.

One needs to be aware of a variation of theme when using fill and zoom. With the former Happy Face is performed automatically before each fill allowing recovery from potential disaster.

Zoom is in my mind an exceptional feature. By displaying an enlarged version of a chosen and specific area of a graphic, the user is provided with an editing facilty par excellence. Here of course the mouse comes into its own. It was difficult at first to capture the correct colour, that is black or white. Practice, and it didn't need a lot, made more perfect.

Once you have got it, each individual pixel can be edited to provide the exact image you require. You are assisted with a display of the section being dealt with in the top left hand corner so there is no switching back and forth to see what effect your editing is having on the primary picture. For the keyboard user the news is I found it needed even more practice before being able to capture the right colour and direct the pixel in the required direction with any adroitness.

Finally in this group are two icons, Eyes and Clear Screen. On using the latter the reserve screen is not affected so the last stored can be returned to the work screen. Eyes allows a neutral view situation to be entered during which it is not possible to effect any changes.

Boxing Clever

Throughout the adapt processes the user is provided, on screen, with a box which is under the control of the mouse. Specific areas of a graphic or a particular location on the screen, depending on the function being operated at the time, are defined within the box. The box icon is capable of being positioned, enlarged or reduced to enclose particular chosen elements of the graphic, prior to adaption or create.

Fill, Pen, Airbrush each present a mobile cursor, indicative of the prospective function, which can be moved into the desired area before activating. It is possible to draw with pens in black, white and dotted line.

Inverse turns black into white and vica versa. Used with Fills and Fonts some good effects can be produced. I was impressed with the instructions for this icon. Also, it was fun experimenting.

Where I have not gone into detail for a particular icon it is because they are straight forward and very easily and readily understood and manipulated. However, isn't there always an exception, something not quite right! Why I asked myself are the icons, both in print in the manual and on the screen menu, for *Black Box Outline* and *Solid White Box* the same? Certainly gave the old thought cells a hard time working that out particularly as I was inadvertently creating a solid white block over some graphics. Could I understand why they would insist on disappearing. Of course I was in a white background at the time, which is a state I would recommend for the majority of work. Large areas of black print are not at all pretty produced with a dot matrix.

Seeing is Believing

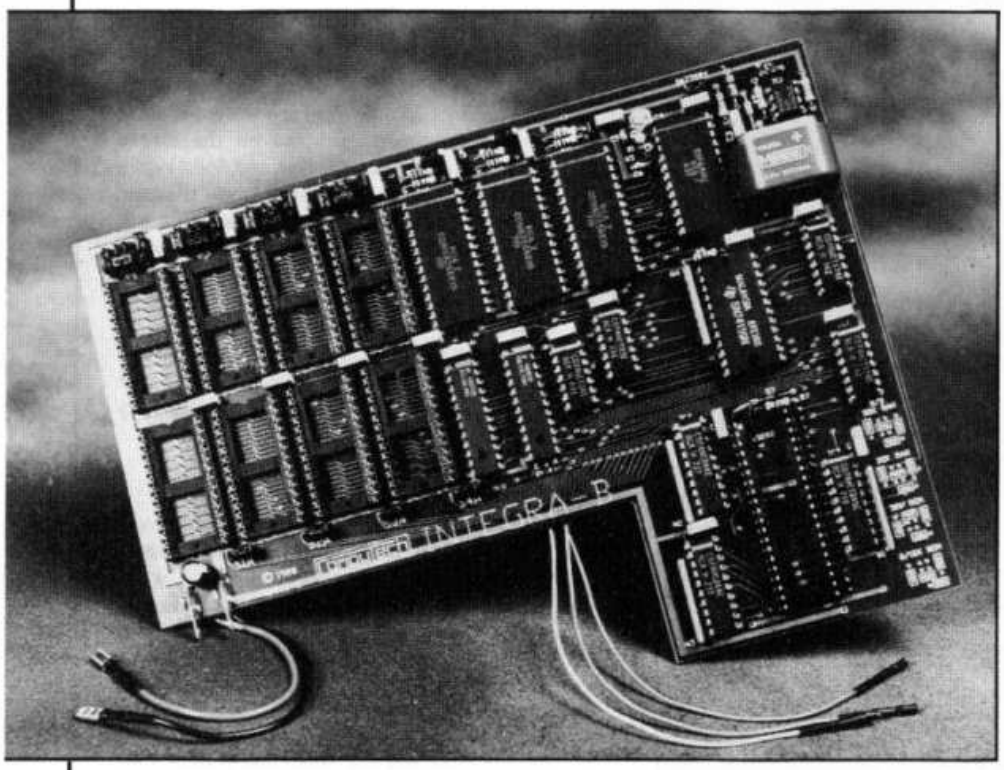
The Printer program can be accessed direct at first load by using the space bar to highlight the Printer icon. However during a work session it is necessary to exit and enter by use of *MOUNT/!BOOT. Insert the user disc after the program has loaded, select disc icon followed by <Return>. This will give you the catalogue from which you enter the file name for the artwork you wish to print. Having done this the menu will appear from which you can choose either view screen or graphic print size (before you move to the print icon). Details of picture size and position appear, by character positions across and line position down. Used to best effect, this enables subsequent text printing around the graphic via your word processor. News letters, menus, invitations, wine bottle labels? The world is your oyster.

What if your printer is not Epson compatible? Never fear Clares have provided a *Printer Configuration program*, which on following the straight forward instructons, will save the day, and all your graft producing the artwork. Oh! a rider. You will need your printer manual.

A quite extensive *Graphics Library* is provided in the package, though I doubt it will be to everybody's taste. It was not to mine, nevertheless it is there, it does illustrate what can be achieved, and it seemed to me the graphics are of a high standard. I'm certain someone, somewhere, will need the library at sometime. Clares offer a custom disc, bespoke I assume, service for which they will quote a price. Clares also claim further libraries are on the way.

Conclusions

A very pleasing package and well worth the price. I agree with the recommendation to use a mouse if at all possible, but am conscious, as I think Clares should be, that perhaps it is not possible for every one to so do. The instructions for using the keyboard, to say the least, are a bit sparse. I had to go through a lot of trial and error before working out all the key uses necessary. I also think there is ample space at the foot of all the pages for two or three lines of instruction on the use of the keyboard to be included. How about it Clares? On the whole a good manual and excellent software.



INTEGRA-B

A new multi-purpose board for BBC B looks set to wipe away the competition!

Clive Grace

Memory comes pretty cheap these days, so cheap, that memory expansion boards abound for the BBC Model B. Watford Electronics, Solidisk, Aries, and ATPL have all produced cracking good products – all designed to expand the standard BBC B's memory to the full in one way or another.

The problem is that if you want to expand the BBC B to the full, by adding Shadow RAM, Sideways RAM, a few sideways ROM boards and a real time clock, you will have to cram in no less than four boards into the underside of the Beeb, thus severely restricting the machine's reliability and accuracy as a working tool, by adding all of these boards to your machine, you can easily bring your computer to its knees simply by over heating!

So the only other option is to fit in an expansion case with a fan and hope for the best, but with this comes the additional outlay of a processor box, some extra cabling, and lots of time.

There is an alternative to all this high tech juggling though; you could alternatively opt for a "go faster board" which has software configurable memory (so you can set a bank of RAM aside for shadow RAM or Sideways RAM) and a faster processor – the only major manufacturer of this board is Solidisk, but the offices at A&B have been plagued with letters complaining about these boards reliability, and the amount of trouble people had been experiencing with the boards when fitted. All in all, quite a mess.

That is, until recently. A company called *Computech* sent in, completely unannounced, a small unassuming box proclaiming itself as the *Integra B* board, to be fitted to the 6502 socket of the BBC B.

The Integra B board provides four sockets of sideways RAM, a further 20K of shadow RAM, a 12K section of private RAM and with eight free sockets for ROMs or RAMs, all of which can be battery backed up.

Installing the board is a doddle. If you can fit a ROM then you can easily prise out the 6502 socket, plug the chip into the Integra board and plug the board into the computer's vacated socket – just add a few cables from the Integra B board to the computer (for power – no soldering at all) and you have a complete and fully working Integra B board!

You can configure the hardware by using special links on the Integra B Board and also by using special software commands actually built into a ROM on the board.

The Integra B operating system is an alternative OS for the Model B, essentially a series of extended FX commands, this new OS provides a facility to permanently configure the computers in much the same way as the Master series or even the Archimedes!

For example, you can configure your computer to start up in shadow mode 0 (known as MODE 128 on the BBC B+ and the Master series) by simply typing ***CONFIGURE MODE 128** followed by a Return. There are sixteen separate configuration options to choose from, and these are easy to understand and simple to use –

Compatibility

Where possible, the commands adhere to the Master 128 and BBC B+ 128 OS commands such as SRLOAD, SRWIPE, *TIME, *DATE... and so on. The real time clock is exceptionally good as it is probably one of the first packages that I can truly rely on as being accurate and easy to use.

By holding down the "@" key when turning on the computer, you can initiate a full system reset (in much the same way as holding down the "R" button on the BBC Master 128 or the Archimedes forces a complete reset). The software actually makes good use of mouse drivers and is immediately compatible with all shadow RAM software including the complete View family, the Inter series, the UMI 2B and 4M board as well as additional memory upgrades such as a 6502 second processor, a Z80 second processor, the Master 512 co-processor in a BBC connection box (either Acorn or Watford's) and all DDFS and DFS releases I could try out.

Construction and Use

I am very impressed with the construction of the board. There are quite literally no corners cut here as the components are made of very high grade and high tolerance (for the less technical, that means the machine will work under difficult conditions such as an over heating BBC B board). The board comes packed in an antistatic bag just for security – and that is impressive...

For the future, a special *Integra windows* operating software will be included with the package – details are scant at the moment, but it will work in conjunction with an AMX or Watford compatible mouse and a new interrupt driven mouse driver will be added to the system – this is to be an upgrade, and I look forward to seeing the extensions with a great deal of anticipation!

I was very happy with the operation of this board from the first moment I plugged it into my previously over laden and gasping Beeb, the machine was running happily with no annoying links to be set, no fiddly hardware links to be set whenever I wanted to use shadow RAM, and some very demanding software.

I *like* this board – buy it!

Factfile

The Integra B board is designed to work with the BBC B. It costs £130 Inclusive. 32K RAM chips for the board cost £10 plus VAT and a special Write Protect switch system is being developed and should be ready by the time you read this article.

The board and more information is available from *Computech, The Garth, Hamsfell Road, Grange over Sands, Cumbria, LA11 6BG.* ☎ (044) 84 4604.

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The MORLEY TELETEXT ADAPTER introduces you to the world of Teletext at a price that won't break the bank. Inside it you will find the latest in second generation Teletext chip technology, which unlike our rivals who are still using chips designed more than ten years ago, will be fully compatible with any future advances in the Teletext system.
With the Morley adapter you will get a state of the art unit that automatically tunes itself into the required station (no more messing around with screwdrivers or twiddling little knobs in the back of the case), a user friendly menu driven program, easy to follow instructions and a 12 month warranty. Add to this the free downloadable telesoftware and we are sure that you will agree that we are offering you one of the best bargains on the market today.

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* Simply plugs into the user port.
* Low power consumption, less than 200ma. Optional power supply available.
* User friendly menu driven software including extended OSCLI and OSWord commands for access from BASIC programs.
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* FREE Telesoftware, no access charges (updated weekly).
* Save selected pages to disc/tape for later retrieval.
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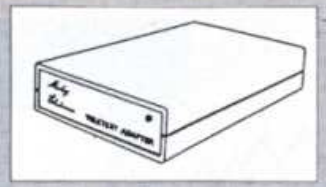
* Gives you a real-time clock at your disposal ("TIME).
* Software upgrades to allow for any enhancements to the Teletext service, e.g.: extra channels, full field data on cable & satellite systems etc. (only the media charge).
* Easy to follow comprehensive user guides.
* No hardware limitations, it can for example receive virtually unlimited numbers of channels.
* Utils disc available including printer drivers allows pages to be selected and dumped direct to a printer (no more TV or Radio Times to buy).



WHAT THE REVIEWERS SAID
"...In terms of price, performance, future expansion possibilities and those little touches that show thought for the end user I would recommend the Morley unit."–*(Acorn User, January, 1986).*
"...The Morley unit has been designed to ensure that its operation is simple and smooth. It is the ideal Teletext adapter for school use."–*(A&B Computing, June, 1986).*
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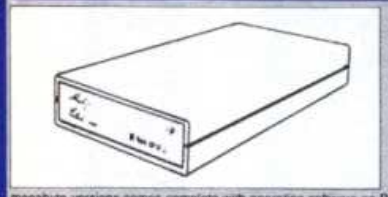
THIS IS THE BIGGEST SELLING TELETEXT ADAPTER CURRENTLY IN PRODUCTION WORLDWIDE, AND COMES WITH A FULL MONEY BACK SATISFACTION GUARANTEE.

RAMDISC



Now available! The first true MEGA capacity RAMdisc for the BBC, BBC B+ and MASTER computers. This fully compatible unit, currently available in either 1 or 2 megabyte versions comes complete with operating software on ROM, power supply, and a comprehensive user guide.

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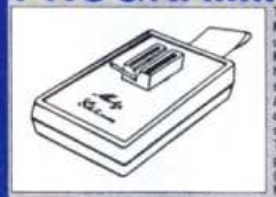
Well that's the spec., add to this our usual 12 month no quibble guarantee and we're sure you'll agree the Morley RAMdisc is the sensible alternative if increased storage capacity and speed is your requirement.

EPROM PROGRAMMER V2



The MORLEY EPROM PROGRAMMER V2 is a small self contained unit that plugs into the BBC or MASTER user port. It comes with a high quality ZIF (zero insertion force socket) and contrasing plastic case. Also included in the package is it's own user friendly menu driven software on ROM or disc.
This state of the art unit, allows programming of 2764 (8k), 27128 (16k), and 27256 (32k) EPROMS. Not only does the hardware allow programming of the usual NMOS devices, but will handle the new generation CMOS equally as well, and with the average time taken to program a 16k at less than 30 seconds we believe it to be one of the fastest programmers available today.
THE HARDWARE
The Unit is completely under software control, there are no knobs or switches to baffle the novice, and the extended features provided should excite the pro's.
THE SOFTWARE
The comprehensive user friendly software included in the package has two main parts, the first allows EPROMS to be read, programmed, verified and edited, also allowing a ROM image to be loaded or saved to disc. The second is a full ROM management system in its own right, which has a host of useful features and routines, such as KILL and RESURRECT ROM to disable or enable a sideways ROM, dump ROM image to buffer or disc, move ROM image in buffer to sideways RAM, and VIEW-SEARCH any sideways ROM.
The whole system is available now for less than the price of one WORDWISE chip. So get yourself the all new MORLEY EPROM PROGRAMMER V2 today and start using those expansion boards for what they were made for! ROMS.
Immediate delivery no quibble 12 month guarantee.

MASTER CARTRIDGES

DUALS – Designed and manufactured by Care Electronics to Acorn specifications. These high quality Master expansion cartridges will take two 16k sideways ROM's, and will, unlike similar cartridges available from other manufacturers, accept the new second generation programs, such as Computer Concepts Interword and Spellmaster ROM's.
QUADS – As Duals but take 4 x 16 Eprom.
These Cartridges come in a high quality, robust, formed-plastic case, that fits neatly into either one of the of Master's cartridge slots.

MASTER SMART CARTRIDGE

This device was designed and manufactured jointly by Morley and Care Electronics.
The **Smart** cartridge will at the press of a button halt any program running in memory and execute any one of a host of useful built in, or user defined procedures, and once completed will return to the program and continue where it left off. The only limiting factor with this device is the programmers imagination.
The **Smart** cartridge will prove useful to the novice, allowing him to do the simple things like dump any screen to printer, and made backups of protected tape or disc based software, but has an open ended specification for the advanced 'HACKER' allowing advanced programming techniques to be incorporated into almost any program at the touch of a button.
BUILT IN FEATURES (at the press of a button)
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Screen dump (any mode) to printer or disc.
Allows any OSCLI command without disturbing memory.
Copies 90% of protected software.
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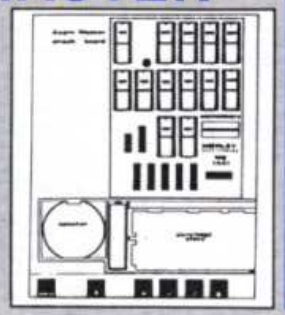
ALL CARTRIDGES COME WITH A 12 MONTH NO QUIBBLE WARRANTY

NEW PRODUCT

MORLEY MASTER BOARD 'AA'



At long last the add-on all MASTER users have been waiting for, an internal ROM board.

No more need to turn the computer off to insert the cartridge containing the ROM you need to debug the program in memory.

The new **MORLEY MASTER BOARD "AA"** allows you to have up to 8x16k and 4x32k extra Roms installed inside your MASTER and still leaves the cartridge slots free. This in effect allows your MASTER to support as many as 24, 16k ROMs installed permanently, whilst retaining the standard 4 x sideways ram banks and four banks by using cartridges.

A staggering 32 ROM images installed and accessible at any time

Included in the package is a utility ROM which has many useful foatures such as 'FICOPY', a clever file transfer program that transfors files between DFS and ADFS formats or vice versa.

So for less than the price of four external cartridges you get a MASTER BOARD "AA" which with twice the capacity has got to be THE ROM expansion for the serious MASTER user.

The unit comes with the usual Morley, full no-quibble twelve months warranty, and our usual after sales service

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Qty. ____	M/B Software Mastercopy ROM	14.95	(c)
Qty. ____	M/B Software Masterfax	29.90	(c)
Qty. ____	M/B Software VU-Fax System inc RAMdisc	249.78	(a)
Qty. ____	5¼" Floppy Discs × 10	8.05	(c)
Qty. ____	27128 16k CMOS EPROM	4.83	(c)
Qty. ____	Info Pack + Demo Disc of all Software	FREE	(c)

Please delete: Adapter software on **ROM/Sideways RAM format**/Software on **40/80 track disc.**

Name _____ Phone no. _____

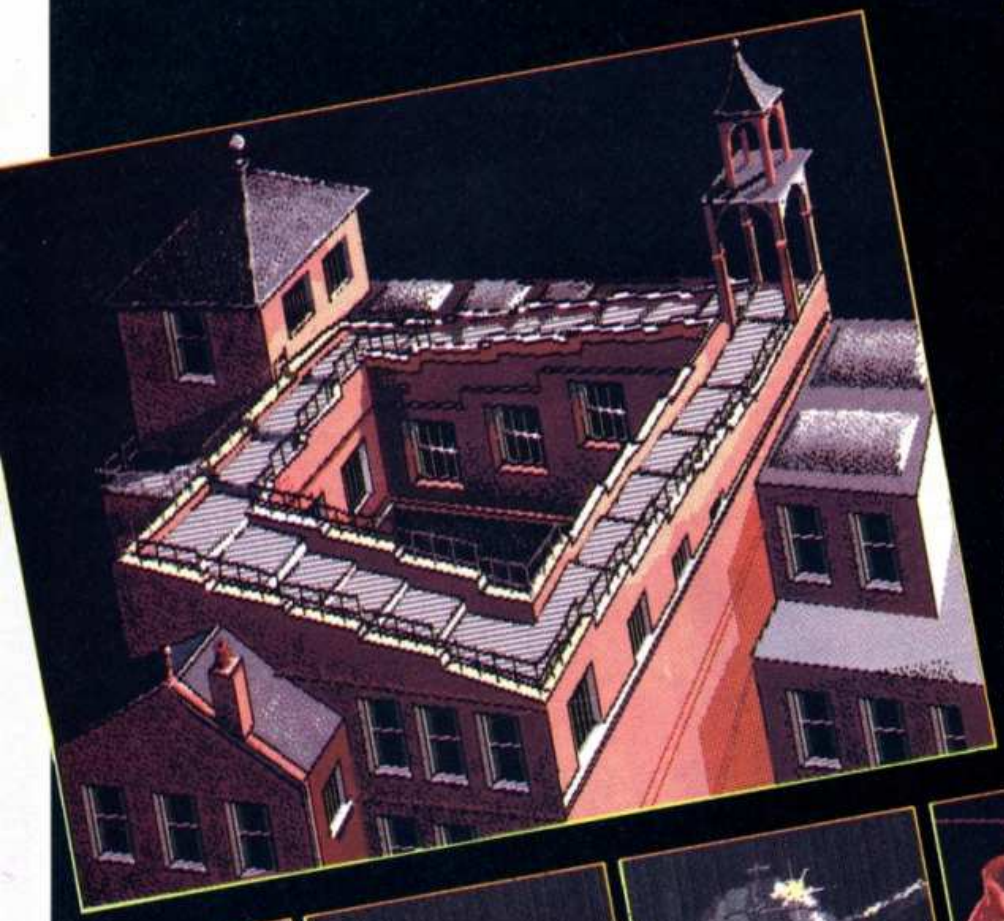
Address _____

_____ Post Code _____

Cheque No _____ Access/Visa No _____ Amount £ _____

Please add Postage and Packing @ a=£3.00; b=£2.00; c=£1.00; d=£0.66. (When ordering more than one item, add P&P on highest rate item only).
GOVERNMENT, LOCAL AUTHORITY, AND TRADE ORDERS WELCOME. Please allow 28 days for delivery.

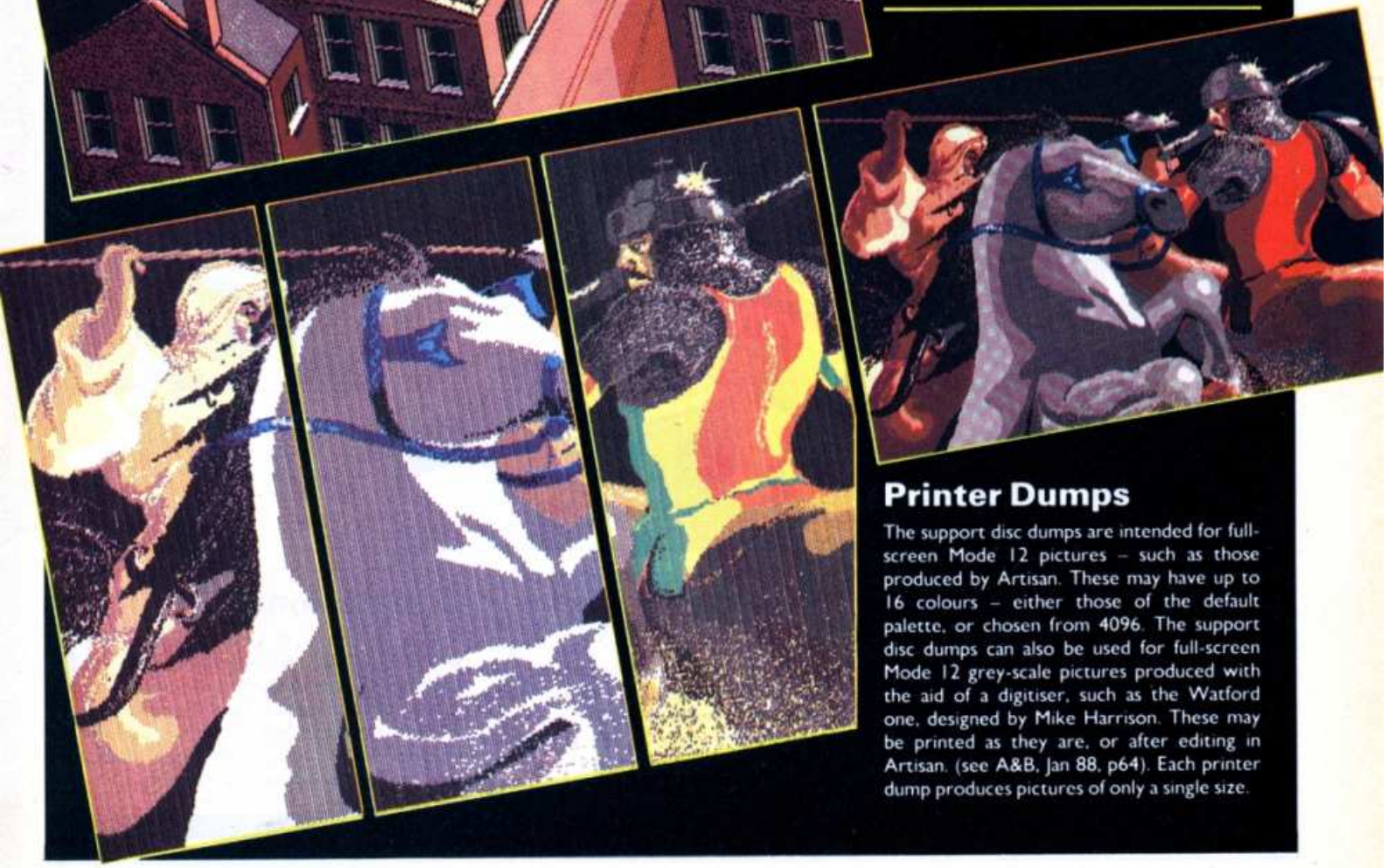
Archimedes
COMPUTING



An in-depth look at Clares' support disc for their Artisan painting package

Slide Shows

The Artisan Support Disc includes a program to display a series of pictures on-screen – using "fades" between one and the next. A *fade designer* is also provided, for users to design their own.



Printer Dumps

The support disc dumps are intended for full-screen Mode 12 pictures – such as those produced by Artisan. These may have up to 16 colours – either those of the default palette, or chosen from 4096. The support disc dumps can also be used for full-screen Mode 12 grey-scale pictures produced with the aid of a digitiser, such as the Watford one, designed by Mike Harrison. These may be printed as they are, or after editing in Artisan. (see A&B, Jan 88, p64). Each printer dump produces pictures of only a single size.

Epson FX and RX Mono

The FX dump uses the Epson *plotter graphics* mode 5, to produce printouts of 226 by 180mm (8.9 by 7.1 in) with the same 1.25 to 1 aspect ratio as the screen. The picture is printed sideways, down the page. Conversely, the RX dump uses Epson graphics mode 4, to produce printouts of 204 by 180mm (8.0 by 7.1 in), which gives an aspect ratio of 1.13 to 1. The picture is printed upright, across the page. The Epson EX-800 can be used to print either of the mono dumps. It is very fast, and takes only 44 s for the FX dump. However, it is also noisier than eg an FX-80.

Epson JX and EX Colour

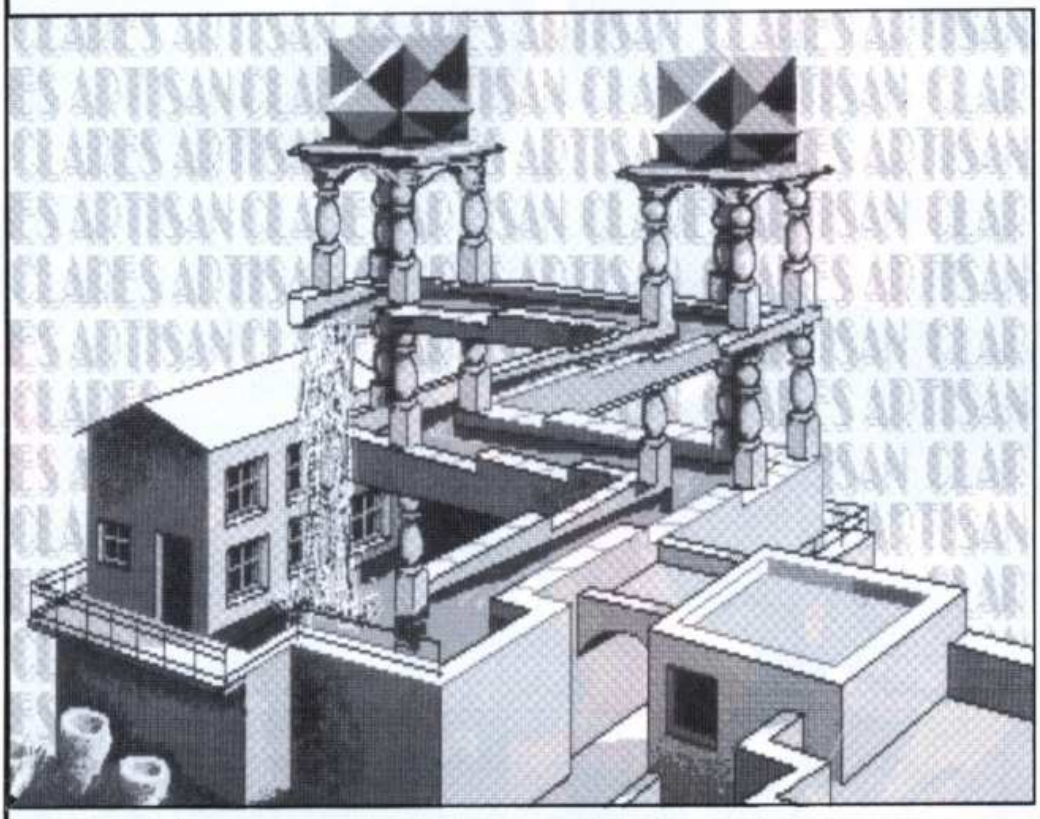
The Epson JX-80 was a dedicated impact colour printer. It has been superceded by the EX-800, to which a colour upgrade kit may be fitted. This allows the use of a four-colour ribbon in place of the plain black. The Star LC-10 is a compatible printer, which is notably less expensive. All such printers make four passes for each 8-pin line – one for each of the four ribbon colours. By overstriking, up to seven colours plus white are produced at full resolution. The support disc dumps use groups of mixed colours to increase the number to 16, but this halves the spatial resolution. The picture is again printed sideways, down the page. The printout is 224 by 162 mm (8.8 by 6.4 in), giving an aspect ratio of 1.38, which is about 10 per cent wider than on-screen. The EX-800 produces a colour printout in about 4 m.

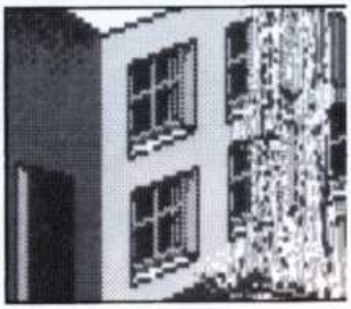
Two Epson JX colour dumps are provided – Col:1 being optimized for pictures using the default palette, and Col:2 which attempts to match any 16 colours. Even with Col:1, the colour matching is less than perfect. Col:2 seems to give truer colours, but only at a further penalty in spatial resolution. The support disc includes a palette editor, which allows the colours printed to be changed by the user. With a new ribbon, the colours produced by these dumps are quite bright. However, there is some ink transfer between the colour bands on the ribbon, which must lead to some dulling of the printed colours with extended use. Also, the picture often shows each print row of 8 dots. This can be severe when printing solid colours, but is invisible with mixed colours (including those mixed with the white background).

Integrex Standard and HQ

The Integrex Colourjet 132 ink-jet printer can produce up to 36 colours at full spatial resolution. (see A & B, 88/1, p 64). For convenience, the support disc includes the same standard dump as is on the Artisan disc. This is suitable for standard paper (in cut sheets or roll), and is relatively quick – taking about 7 m. The picture is printed across the page, and is 194 by 153 mm (7.6 by 6.05 in) – giving an aspect ratio of 1.27, which is very close to that on-screen. The Integrex standard dump is pale – close to both the Epson colour dumps – but the print rows are almost indetectible.

The real star of the support disc is a *High Quality* dump for the Integrex. This requires the use of special coated paper (in cut sheets or roll), which is more expensive, and takes roughly twice as long – about 15 m. However, the results are well worth the wait. Whereas the standard looks like a water colour, the HQ looks like an oil painting ! Indeed, HQ printouts even look brighter than the screen ! The Integrex can also print on overhead transparency film (of special type), and the HQ dump, with its intense colours, is especially suitable.





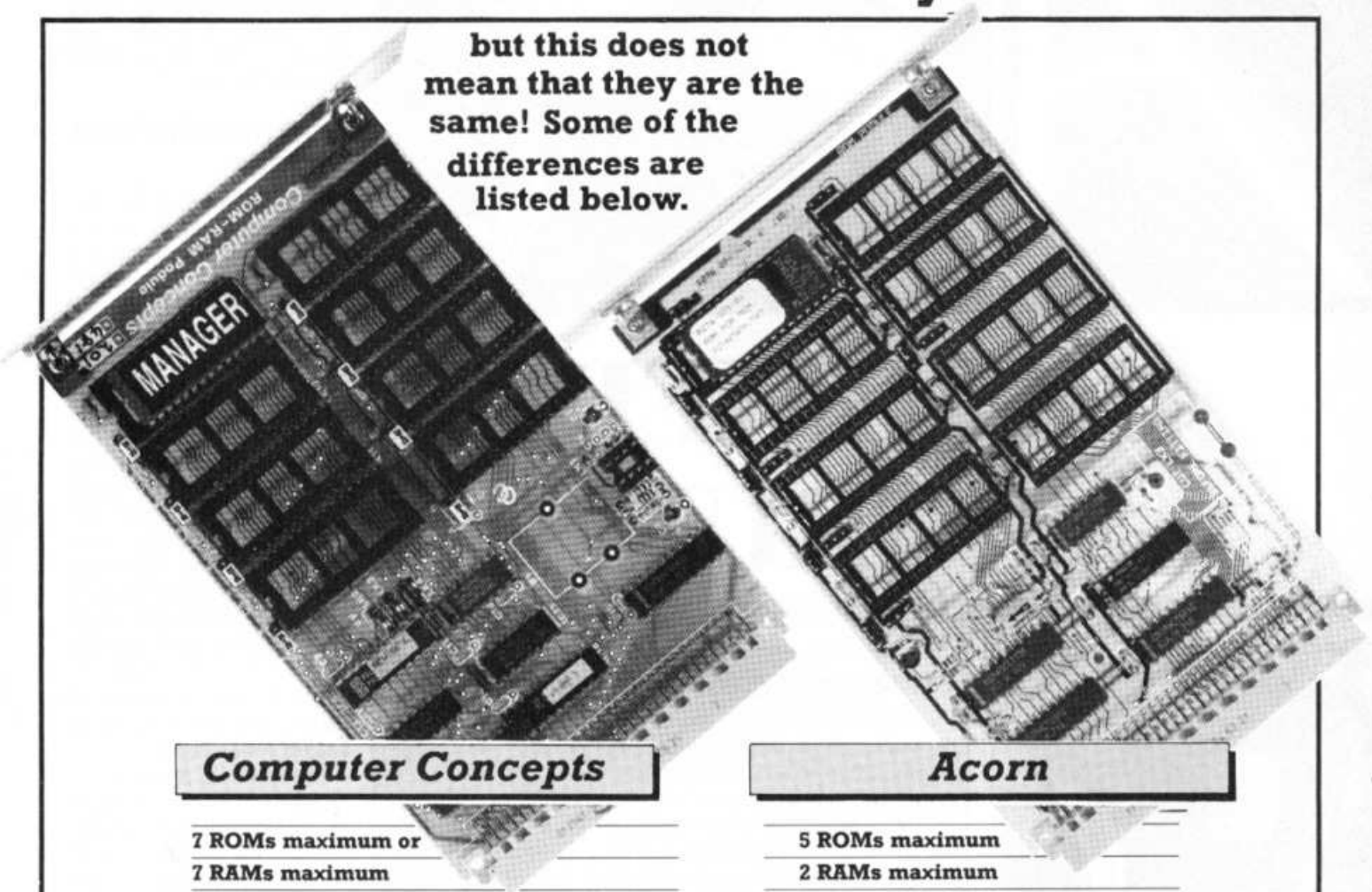
The mono dumps use patterns to produce a 16-level grey-scale, but this lowers the spatial resolution. Thus text, even the large font provided in Artisan, is barely legible. The support disc includes a pattern editor, which allows the user to make adjustments to suit a particular type of picture. More than one pattern may be stored on the disc, and loaded in place of the default. The pictures are also poor in contrast. However, they provide hardcopy from the mono printers that most users already possess.

Conclusions

The Artisan Support Disc, priced at only £19.95 inc VAT, is well worthwhile for anyone who uses Artisan at all extensively. For producing colour hard copy, impact printers are much less expensive, but the Integrex ink-jet produces far better results, and those of the HQ dump are superb.

The two ROM boards may look alike

but this does not mean that they are the same! Some of the differences are listed below.



Computer Concepts	Acorn
7 ROMs maximum or	5 ROMs maximum
7 RAMs maximum	2 RAMs maximum
Supports 8k, 32k, 128k RAMs	Supports 32k RAMs
Complete ROM filing system	Limited ROM filing system
Automatic device type detection	Manual link device selection
Automatic device configuration	Manual command configuration
Fast file transfer (280k bytes/sec)	Slow file load (30k bytes/sec)
8 files open at once	1 file open at once
Complete RAM filing system	NO RAM filing system
Multiple boards extend RAM filing system	Not possible
896k RAM maximum per board	64k RAM possible per board
Price £49.00 + VAT	Price £59.00 + VAT

The potential for Archimedes software without a ROM podule is severely limited. There will be many ROM based programs in future, in addition to INTER-WORD, SHEET, CHART and SPELL-MASTER, which are already available. Remember, ROM based programs on the Archimedes still have many of the same advantages over disc based programs that they had on the BBC; programs load faster, they are more reliable, they are permanently available and, most important, such programs can use overlay techniques to save a large proportion of the available memory. Consider running a document processor, spelling checker, drawing program and perhaps a thesaurus; the total program size could easily be over 600K—totally impractical, even on a 1 Meg machine.

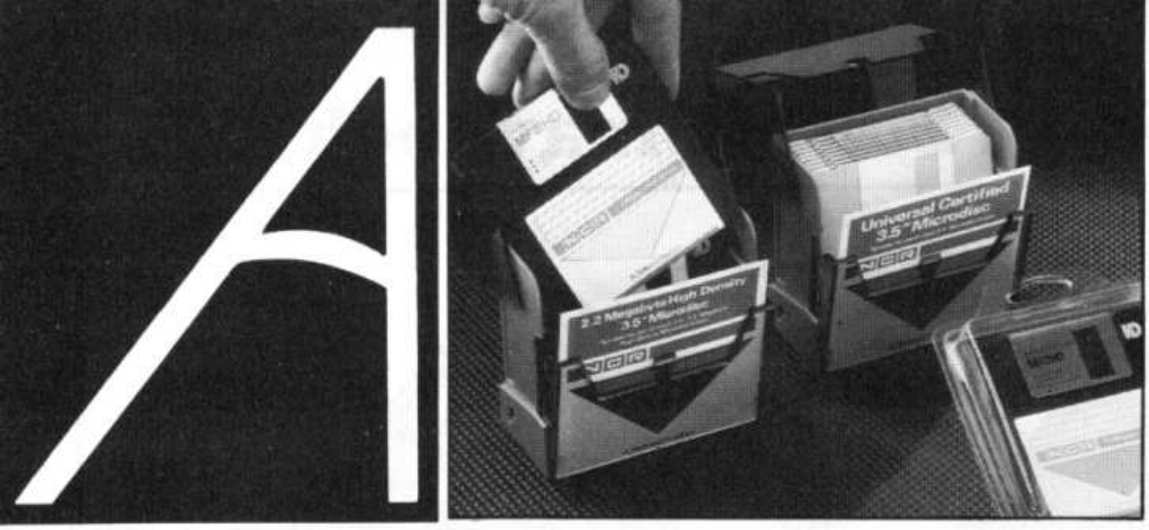
In addition the Computer Concepts' board can be used as a very fast RAM filing system, and our experience is that many boards are used for this. A program that uses the floppy disc intensively will gain from the RAM filing system, which is about 10 times faster than floppy.

Our board is fast, cheap, flexible, expandable and easy to use. We also provide a no quibble money back guarantee. In a comparison, the facts speak for themselves.

Please note: A backplane must be fitted in order to install any podule expansion card.

Computer Concepts Ltd

Gaddesden Place, Hemel Hempstead, Herts HP2 6EX Telephone 0442 63933



ARCHIMEDES FORUM

NCR assurance

Certified 100% error free, NCR's high density 3.5" discs cost £22.00 + VAT for a plastic library case of ten.

Northern Ireland installs

Fifty Four Archimedes 310s have been purchased by the Western Education and Library Board of Northern Ireland to equip schools in the Londonderry, Limavady and Omagh areas.

One Grammar and two High Schools will have specially created "Archimedes rooms" each equipped with ten micros. The computing facilities will be used for GCSE and GCE A level course activity as well as general class work contained within the school curriculum. Twelve Archimedes are being installed at the Micro Tech Centre, the Board's educational computing centre in Omagh, County Tyrone, to provide in-service training and support for teachers who will be using the systems in the classroom.

The remaining micros are intended for curricular projects to include music, art and the production of class magazines. Acorn dealer CEM Computer Services supplied the computers.

Acorn's Ian Lawrence greets a representative of Hugh Symons

Price upgrades

Recommended retail prices for some Archimedes products have been revised by Acorn. The Archimedes 305 remain unchanged in price with the 512K upgrade to 1Mbyte now costing £149. The 310 and 440 machines without monitors will be £835 (from £875) and £2529 (from £2299) respectively. With mono monitor the recommended prices are £895 (from £925) and £2589 (from £2349), with colour monitors £1055 (from £1075) and £2749 (from 2499) respectively.

Peripheral prices have also been changed. An additional floppy disc will cost £125 and a 20Mbyte hard disc and controller card will be £499. For both the 300 and 400 series the I/O expansion card will be £85 and the music MIDI add-on for the I/O card £39. The newly available separate MIDI expansion card will be £69. All prices are exclusive of VAT.

Meanwhile Acorn has appointed its third distributor, Hugh Symons, to work in the fields of health, education and corporate accounts. Hugh Symons joins Kelator and A B European.

What about you?

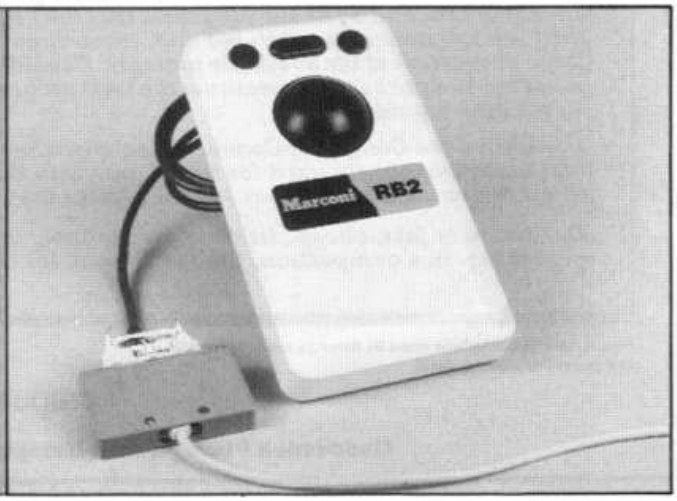
We here at A&B are always interested in hearing about you, the user – why you bought an Archimedes, when you bought it, and what software you are using with it. If you have any gripes, then by all means send them to us – it's not only the good news we want to hear!

ROM card

Acorn's own ROM expansion card provides five fully-configurable ROM sockets, each of which can accommodate 16 to 128 Kbyte ROMs or EPROMs. Also provided are two sockets for static RAM chips with up to 32Kbyte capacity. This RAM can be used to develop suitable ROM format programs for blowing into EPROM for distribution.The card costs £59.00 + VAT and can be fitted to any machine equipped with a backplane.

Trackerball adaptor

Pineapple Software have devised an adaptor to allow Marconi trackerball owners to use the device with their Archimedes in place of the mouse. A one metre cable has the user port socket at one end and the mouse plug on the other. A case of simple but brilliant. Price £13.95 + VAT. Available from Pineapple Software, 39 Brownlea Gardens, Seven Kings, Ilford, Essex IG3 9NL. ☎ 01 599 1476.



Textual database

Texcellence have released their program ArcTFS for the Archimedes. ArcTFS is a "free text" database. Sean O'Conaill of Texcellence tells us that the program was born "out of frustration with the normal database software available for the BBC B".

ArcTFS is a greatly enhanced version of the one currently sold for the Atari ST. Sean says that "the processing and filing speed of the Archimedes adds a new dimension to the program". Those upgraders with large Wordwise or View files might appreciate its database style control over text and TFS' ability to reformat for First Word Plus.

ArcTFS has its own mouse-driven horizontal menu system incorporating a mouse help system similar to that demonstrated in the music program on the Arc Welcome disc.

Current uses for the program include filing excerpts from minutes of business meetings, filing and searching items of local history data and filing data for the composition of a book on crosswords.

Future likely developments include a link to the Z88 portable computer and compatibility with any other advanced wordprocessors released for the Archimedes, such as Pipedream and Cornputer Concepts much vaunted DTP software.

Price £29.95. Available from Texcellence, 2 Greenhill Road, Coleraine, N.Ireland, BJ51 3JE.

Would you believe it department

The first listing ever published in A&B Computing, all of five years ago, was Cells and Serpents. The game went on to be a best seller on cassette and was much loved by BBC adventurers. To our surprise a copy of Cells and Serpents recently turned up in the office on a 3.5" disc. An adventurer new to the game with requesting a help sheet? Someone having problems converting it for the Compact? A three dimensional graphics version for the Archimedes? No. It couldn't be. But our picture confirms the truth. Alex Hopkins has brilliantly converted the game for the Arc. It looks good and plays just like the original. Old timers and new can now enjoy the game. It's on issue four of our Archimedes support discs. Order DA4 from our advert this month.

Nova Fisher and Minerva compatriots support their claim that their Sigma Sheet package holds the largest in the world.

Desktop fun

Gem Electronics have included a "mystery" game in their Desk Top Games software.

OS Bug

Contex Computing have alerted us to a potential problem in converting BASIC programs to the Arthur OS. On the Model B and Master the *FX220 command allows the selection of an alternative ESCAPE key, eg the Space Bar has the ASCII code of 32 therefore *FX220,32 will cause the Space Bar to act as the ESCAPE key. However *FX220,0 which should make <CTRL-@> be the ESCAPE key not only sets <CTRL-@> but also allows the pound, accent and some other keys to also generate ESCAPE.

This came to light while converting the Contex Archimedes Bank Manager and the latest version has fixed the problem. An SAE will ensure a free upgrade to initial purchasers. Details: Contex Computing, 15 Woodlands Close, Cople, Bedford MK44 3UE. ☎ 02303 347.

Scroller roller

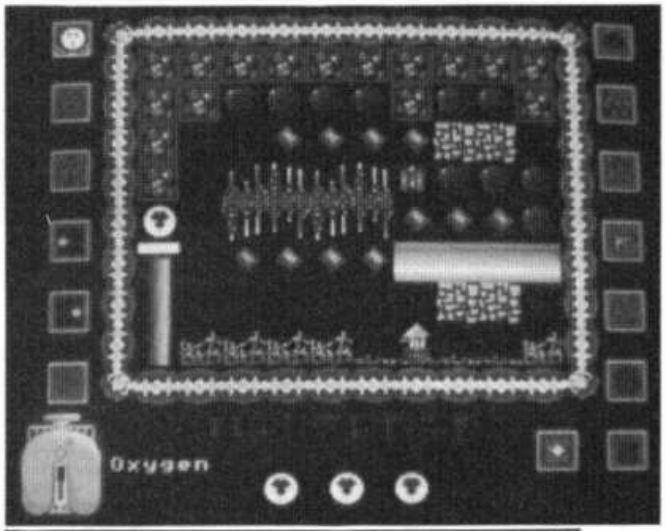
by Keith McAlpine

A quickie message display program for you this month with super smooth scrolling in Mode 5 on the Archimedes.

LISTING

```
  10REM >ScrollText
  20REM Scrolling MODE 7 text
  30REM by Keith McAlpine
  40
  50DIM block% 4
  60delay%=4
  70
  80end%=FNtext
  90MODE5
 100OFF
 110
 120REPEAT
 130PROCscroll(0,end%,160)
 140wait%=INKEY(delay%*10)
 150PROCscroll(end%,0,-160)
 160wait%=INKEY(delay%*10)
 170UNTIL 0
 180
 190END
 200
 210DEFPROCscroll(start%,end%
,step%)
 220FOR lp%=start% TO end% ST
EP step%
 230?block%=2:block%!1=lp%
 240SYS "OS_Word",&16,block%,
block%>>8
 250wait=INKEY(delay%)
 260NEXT
 270ENDPROC
 280
 290DEFFNtext
 300MODE7
 310PROCce("Scrolling Text")
 320PROCce("by Keith McAlpine
")
 330PROCce("(C)1988 A&B Compu
ting")
 340PRINT"Use a maximum of 5
0 lines with 20 charsper line
..Colours will not be display
ednormally but in a set of col
oured pointsmade up from the 4
 colours available inMODE 5.
Press ""@"" to stop entering t
ext."
 350VDU31,0,13:done%=0
 360y%=0:word$=""
 370REPEAT
 380K=GET
 390IF K=64 THEN done%=-1:GOT
O480
 400IF K=13 AND y%<49 THEN VD
U10:y%+=1
 410IF POS>=20 THEN
 420IF K=32 THEN PRINT:GOTO44
0
 430IF y%<49 y%+=1:PRINT;STRI
NG$(LEN(word$),CHR$8);STRING$(
LEN(word$)," ");PRINT word$;"
";
 440VDU8
 450ENDIF
 460VDU K:word$=word$+CHR$(K)
 470IF K=32 THEN word$=""
 480UNTIL done%
 490end%=(y%*1600)+1600
 500WHILE y%<50
 510VDU13,10:y%+=1
 520ENDWHILE
 530=end%
 540
 550DEFPROCce(text$)
 560c%=128+(RND(7))
 570PRINTTAB(((40-LEN(text$))
/2)-2);CHR$c%;CHR$141;text$
 580PRINTTAB(((40-LEN(text$))
/2)-2);CHR$c%;CHR$141;text$
 590ENDPROC
```

Missile Control from Minerva is fast, furious and addictive fun. It harks back to the days of the BBC Micro version.



Hoverbod – another game from Minerva. This could be the Archie's very own Bone Cruncher!

Archimedes Teletext

By Ann Owen

Through the release of their Universal Teletext Adaptor, Solicomms Technology have become the first to supply a teletext facility for the Archimedes.

The Solicomms *Universal Adaptor* will work equally well with the BBC Micro (where it is a competitor to the Morley Teletext Adaptor) and the Archimedes.

The Universal Adaptor hardware is the same for both computers but the cabling and software, both provided, are different. The unit has its own power supply, a socket for the TV aerial, a DIN connection to the computer and an auxilliary socket. The latter provides composite TV video and TV sound for Phillips colour (CM8833) and mono (BM7522/BM7022) monitors. A cable is not supplied but is a widely available DIN to Phono arrangement.

The Archimedes connects to the adaptor via the Centronics port, which immediately has the effect of disabling any printer you might have attached. It is unlikely that you would wish to use printer and adaptor together. Any teletext screens can be saved to desk before printing "offline", once disconnected. What this form of connection does mean is that you do not need to purchase an IO podule to use the adaptor.

Telesoftware

The Solicomms TTX software is controlled by single key press commands. H holds a page display while a second press cancels the hold. P shows an alphabetical menu of telesoftware which can be selected for downloading by pressing the appropriate letter.

Automatic downloading is possible through the use of the wildcard. I didn't try it but the slim manual suggests that it will take about eight hours to download all the free telesoftware for each week. But with this autoload feature you can leave it downloading overnight.

The R command reveals (and hides) hidden text. Quizzes and other entertainment pages often make use of hidden messages. The S command saves the screen display to disc under a filename provided at the prompt.

The @ command calls up the "fast-text" facility. Some pages have links into other pages. @ displays the link information for the current page. Four coloured boxes corresponding to special colour buttons on the latest Teletext handsets are shown on the bottom line. The function keys f1 to f4 have been set up as equivalents. They select one of the link pages without having to type in the page number. The PRINT key (f0) is set up to return you to the main index page.

Tuning in

The software comes on a single 3.5" disc and it provides tuning and channel selection. The frequencies for 63 transmitter areas are known to the software and you simply choose your most local. Fine tuning can then by carried out with a couple of key presses. The setting can be saved in order to customise your disc (which can be backed up).

If you can receive different ITV regions then it is possible to customise a variety of discs so that you can be instantly tuned in to your choice. Oracle (the ITV teletext service) carries varying regional information.

Pressing the keys 1 to 4 simply selects the channel required. Each channel contains different information. The computer and telesoftware section, for instance, is on BBC 2.

Conclusions

Although the teletext adaptor works well with the supplied Archimedes software, it is noteworthy that the software features fall short of those available on the BBC Micro with Advanced Teletext System, either the Morley version – licensed to them by the BBC – or the Acorn teletext adaptor with its version of ATS. The new GIS adaptor claims to offer even more advanced features for BBC Micro owners. No Archimedes version is yet advertised.

Model B/Master

It has been pointed out to us that, although the Solicomms teletext adaptor will work with the Morley version of the ATS, this software is only licensed to Morley and is not available on its own. The ATS upgrade supplied by BBC Soft will not work with the Solicomms hardware.

Factfile

Contact Solicomm Technology at: 87 Bournemouth Park Road, Southend On Sea, Essex. SS2 5JJ. ☎ 0702 335511

Facinating fractals — a rare insight into the world of "Computer Landscaping"

Keith Smillie

PLANET BUILDING

Many readers will already be familiar with the Mandelbrot set, a simple formula which, when reiterated many times produces stunningly beautiful pictures with a seemingly infinite level of detail to be explored. This set is one object out of many that are to be found in a branch of mathematics known as fractal geometry. This article will describe another fractal that can be used to generate realistic looking fractal landscapes.

The term *Fractal* was coined by *Benoir Mandelbrot* in the 1960's when he was working at Harvard. He used the term to describe objects that exhibit self-similarity, that is objects for which a small part looks either exactly or statistically identical to the whole object. Examples of such objects, fractals, abound, both in the abstract world of mathematics and in the everyday world around us. A branch of a tree, if it is chopped off and stood on its end looks like the whole tree.

If we zoom in further and look at a small twig it still looks similar to the whole tree and we can carry on further, right down to the level of a single leaf. Not surprisingly a tree is a statistical fractal. The number of examples is endless; rivers are fractals, clouds,the nervous system and lightning are all fractals, music and even the flow of traffic on a motorway are fractals and, importantly for us the relief of the earth (or any other planet for that matter) can be modeled by using fractals.

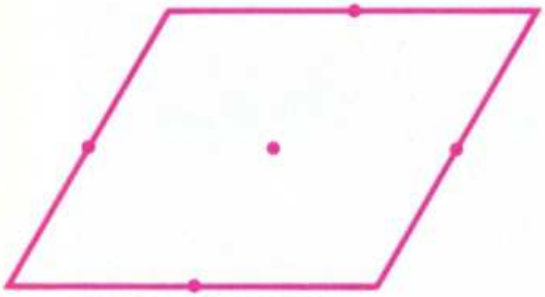
Generating a "true" fractal landscape as described by Mandelbrot involves some quite tricky maths (essentialy discrete fourier transforms in two-dimensions) and as a consequence a very large and powerful computer. In fact any readers who have seen Mandelbrots' fractal landscapes in his book "The Fractal Geometry of Nature" might be interested to know that he had an IBM mainframe to generate his mountains! Stuck with the humble Archimedes an alternative method must be used.

The algorithm used in the program uses recursive sub-division to determine the shape of the landscape. This algorithm has several Advantages over more mathematically accurate algorithms; it's easy to understand (an explanation follows shortly); its easy to implement; and most importantly it requires very little memory, in fact the basic program will fit into a standard BBC micro although without all the colours! The algorithm also solves one of the biggest problems of making fractal landscapes – that of hidden surface removal.

When rendering any three dimensional object on a two dimensional screen hidden surfaces must be removed otherwise the resulting image will be very ambiguous, however most hidden surface removal algorithms require that the infomation about the whole image be maintained either in the computers memory or on say a floppy disc. This is fine for small images but for complex images such as landscapes it is inpractical to store such huge amounts of data, at least it is when the computer only has 512K of RAM.

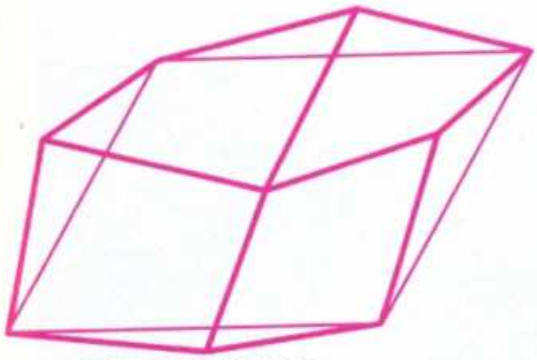
Vertices Anyone?

The landscape in *Figure 1* contains about 100,000 vertices, if each vertex is represented by one real number then storage of the order of 1000 MBytes would be needed! There is no need to panic though, there is one hidden surface algorithm that is very simple to implement and what's more requires no long term storage of data. The algorithm is called the painters algorithm because it uses a technique similar to that used by painters, one simply paints the background first and then paint successivley closer objects on top of what's already there.



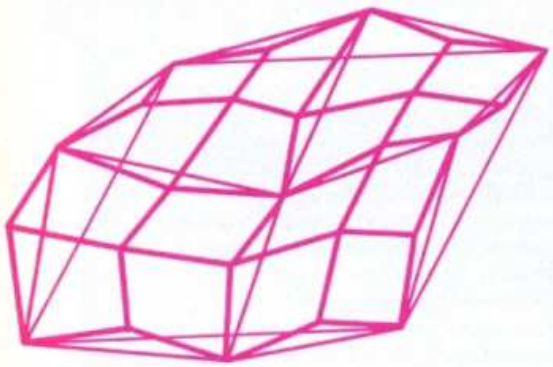
ITERATION ZERO

To use this method we must be able to guarantee that all the facet are painted in strict back to front order. Recursive subdivision is ideally suited to this method as



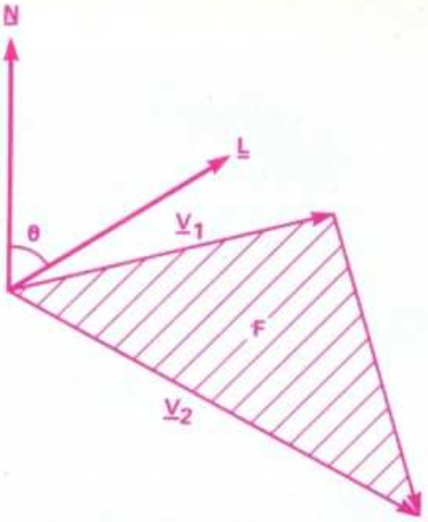
ITERATION ONE

we can always ensure that facets are produced in back to front, left to right order. Producing a fractal landscape consists of essentially two stages. Firstly the



ITERATION TWO

shape of the landscape must be determined, this stage can be thought of as producing a wire frame model of the landscape. It is in this section that we need to



◀ **V_1 AND V_2 are vectors along the edge of the facet. N is perpendicular to V_1 and V_2, L is a vector pointing towards the light source. The size of the angle ⊖ determines how brightly the facet F is illuminated.**

use fractal geometry. The second stage is to "clothe" the wireframe model with coloured patches, the colour of which is determined by some shading algorithm. This stage constitutes the bulk of the program and has absolutly nothing at all to do with fractals.

As mentioned above the shape of the landscape is generated using a technique known as recursive subdivision (see *Figure 2*). The landscape starts life as a flat square in 3-D space. We then determine the coordinates of the center of the square and of the four sides. This process splits the original square into four smaller squares. The procedure that splits the square then calls itself four times, once for each of the newly formed "sub-squares" thus forming sixteen "sub-squares" from the original square.

We repeat this process of sub-division further and further until the squares are as small as we require i.e. the more levels of recursion the greater the amount of detail. Increasing the amount of detail does have quite a severe time penaltythough, for every new level of recursion introduced the execution time increases by a factor of four over the previous level of recursion.

So far so good! We can split an initial square into as many small squarelets as we like, but we still have a flat square! The trick used to turn the flat square into a mountain is to displace each new vertex verticaly by some random amount. When a new vertex is produced its vertical component is displaced by a Gaussian random number multiplied by some roughness factor. A Gaussian random number behaves in the same way that thing often cluster round an average (such as the way peoples heights vary from the average height) and as such is useful when modeling "natural" things. The RND(1) function on the Arc (and BBC) produces a random number uniformly distributed between 0 and 1, that is any number between 0 and 1 is equally likely to occur. The function GAUSS in the program on the other hand produces random numbers whose average value is zero and distributed such that about half the values are positive and about half negative and the further away a number is from zero the less likely it is to occur. As we add more and more detail to the picture (by increasing the level of recursion) the amount by which the new vertex is displaced is made smaller and smaller by using the roughness factor to modify the size of the Gaussian random number.

After a square (they are not really squares unless they are looked at from directly overhead) has been generated it is split into two triangles and is then, if neccessary, clipped with a horizontal plane representing the waterlevel. This clipping process consists of determining whether the triangle intersects the waterlevel and if it does then "folding" the portion of the triangle that lies below the waterlevel upwards until it is horizontal. The clipping process produces two facets from one triangle, a part that is land; and a part that lies horizontaly along the waterlevel.

The final stage in producing the wireframe mesh is to transform the three-dimensional points into two-dimensional screen co-ordinates. This transformation has been kept as simple as possibly to reduce the amount of computing time taken.

The BBC connection

As a matter of interest to owners of BBC's and Masters nothing has been done so far that can't be done on a standard BBC, in fact the original version of this program was written in ISO-Pascal running in MODE 1 on an unexpanded BBC B. A simple colour scheme consisted of green for the land, blue for the sea, cyan for the sky and black to outline all the facets!

For those of us lucky enough to own an Arc all that remains is to colour each of the tiny facets in an appropriate colour. The landscape is drawn in MODE 15 so we have 256 colours to play with. In the original version of the program the only way in which the shape on the landscape could be conveyed was to outline each of the individual facets. The biggest disadvantage of this method is that facets can only be made so small, if they become any smaller the area bounded by the facet reduces to zero and the landscape turns into a large black blob!

On the Arc though the shape of the landscape can be conveyed by colouring each of the different facets in a different colour in such a way as to give the effect of light and shadow. Since there is no outline around the facets they can be made as small as required, even down to the size of a single pixel. The colour of a facet is dependent upon several things; the orientation of the facet to the light source – this determines how bright the facet will appear; and the altitude of the facet above the water line – this determines what colour the facet will be, whether it is green, white, grey etc.

To determine the intensity of a certain facet we need to use a little vector geometry. Firstly a vector perpendicular to the facet is determined by taking the vector product of two vectors forming the edges of the facet. The scalar product of this vector and a vector pointing towards the light source gives the cosine of the angle betweem the light source and the facet (see *Figure 3*). The larger the angle

the more the facet is pointing away from the light and thus the smaller the intensity.

The altitude of a facet is simply the average of the heights of the vertices making up the facet, however, to make the boundaries between adjacent layers (eg snow and rock) more natural looking a random Gaussian number is added to the altitude, this has the effect of spreading the bands out so that they blend into each other. Once we have the altitude of the facet the type of material from which the facet is made can be determined by comparing the altitude agianst a list of heights at which different materials start. For instance the default list consists of earth, grass, rock and snow. The actual colour of the facet is obtained by examining a lookup table of colours to see exactly what COLOUR and TINT settings correspond to say brightly illuminated rock.

The colour of the water is determined in a similar way, the altitude of the land below the waterlevel is calculated and the colour of the water is determined as a function of this altitude and a random number.

Landscapes to Order

When the program is run the user is prompted to enter various parameters then govern precicely how the landscape will be drawn. The number of iterations governs how detailed the picture will be, and as a consequence how long it will take to draw. Four iterations gives enough detail to see what the rough shape of the landscape will be and takes about 40 seconds to draw. For every extra iteration the time taken increases by a factor of four over the previous number of iterations. A value of 8 is the highest number that will be needed as the individual facets are about the size of a single pixel (at least they are in MODE 15).

The elevation and rotation parameters allow the landscape to be viewed from different angles. Both these parameters are measured in degrees. In the case of the elevation it is the number of degrees from the vertical; in the case of the rotation only values in the range 0 – 90 are valid so as to preserve the back-to-front, left-to-right order in which the facets are produced. The viewing distance parameter will obviously make the landscape bigger or smaller, a typical value for the distance will be about 2.

Perhaps the most important parameter is the random seed. For each different seed a different landscape will be produced. Many of the seeds will produce landscapes that are unusable because they have a huge mountain right at he front of the field of view so a lot of experimentation needs to be done to find interesting landscapes. One trick to use is to look at landscapes from directly above (elevation=0) until a suitable seed is found.

The next three parameters determine how the landscape is illuminated. The elevation and rotation of the light source determines how deep and in what direction shadows are thrown, the larger the elevation the deeper the shadow. The rotation may take any value, not just 0-90 degrees. The background level alters how dark the darkest shadow will be, in most cases it is best to set this parameter to zero.

Since Gaussian random numbers can take any value it is quite probable that very large values (and hence very large mountains) can be produced. The vertical scale can be used either to squeeze a tall mountain so that it fits on screen or to stretch an otherwise flat landscape and exagerate surface detail. The roughness parameter (or fractal dimension) allows the user to alter how rough the landscape will be. Typical values for the roughness are in the range 1.5-2.5, smaller values giving rougher landscapes.

The final group of parameters determine how the different bands of colour are displayed. The waterlevel is self-explanatory, the usual value to start with is zero and then increment or decrement it in steps of about 0.1. The beach, grass and rock levels determine how wide each of the bands will be and at what height above the water level they start. Anything above the rock level will be treated as snow. Note that these ranges are not a function of the vertical scaling parameter mentioned above, if the scaling parameter is doubled then each of the levels must be doubled in order to maintain the same ratios of say snow to rock. The final parameter varies the amount by which adjacent band overlap and spread into each other.

To give some idea of what parameters to use *Figure 4* was generated using the following parameters:

iterations	**5**
elevation	**80**
rotation	**0**
viewing distance	**2**
seed	**0.1**
light elevation	**90**
light rotation	**60**
background	**0**
vertical scale	**0.2**
roughness	**1.8**
waterlevel	**-1.2**
beachlevel	**0.1**
grasslevel	**1.5**
rocklevel	**1.8**
band spread	**0.2**

To produce the picture in *Figure 1* a slightly more involved path must be taken. As the program stands it draws a square fractal landscape centred on the origin with a side length of 2. The program does this by first initialising the global variables just detailed above and then calling **PROCdraw–landscape (x,y,iterations)** where x and y are both zero and iterations is the global variable of the same name. To make a larger landscape all that needs to be done is insert more calls to **PROCdraw–landscape**. For example **PROCdraw–landscape (0,-2,iterations)** will draw another square "patch" directly in line with but behind the first one. Similarly we can draw patches to the left and right of the first one and so create landscapes stretching into the distance.

Size and Speed Payoff

Note that as the patches get further away so the size of them decreases and the number of iterations needed to draw them will decrease, thus we can save a lot of effort if we make calls to PROCdraw–landscape with instead of iterations we use say iterations-1. In fact it would be possible to pass other parameters to PROCdraw–landscape and then modify these parameters for different patches. For example we could modify the vertical scale and the roughness such that we have a smooth landscape in the foreground rising to lofty peaks in the distance.

There is one problem with varying parameters across different patches and that is one of continuity. If the changes are too sharp then discontinuities will become apparent where adjacent patches meet, the effect will be to have gaps in the landscape through which the sky can be seen! These effects can be reduced by making the changes as smooth as possible and by making the pictures as detailed as possible. As a last resort one could save the whole screen as a sprite and then touch it up using to sprite editor program from the welcome disc.

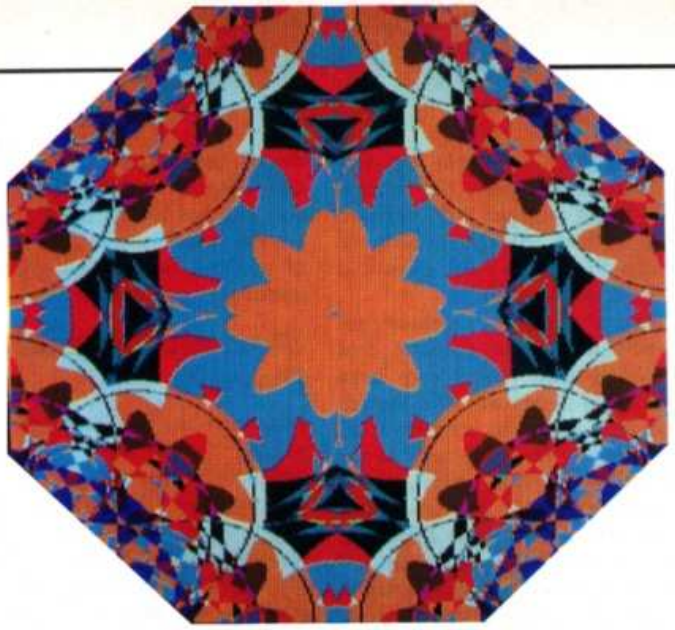
Modifications to the program could include different colour schemes to simulate desert or martian landscapes; or the palette could be redefined to allow more subtle shading. One could try simulating clouds instead of just having a plain sky. If anyone has an A440 they could even make an animated film of a flight over some mountains a 20MByte hard disc could hold about 100 frames! The program is in no way the ultimate in landscape builders so go ahead and see what interesting pictures can be produced, happy mountain building!

Where to get the Fractals Disc

Fractals is available as a special disc – called DA4 this is the Archimedes "Graphics" disc chock full of fast graphics routines and utilities. The price is £7 and is available from our *Reader Services,, 9 Hall Road, Maylands Wood Estate, Hemel Hempstead, Herts, HP2 7BH.* Visa and Access cards are accepted. ☎ (0442) 41221.

Keith Smillie is a student using an Archimedes at Leeds University – his fractals package is the fastest fractal landscape generating program on any sub-£1000 computer system.

Lennon Trail



Experimentation is the key to success with our Archimedes graphics programs this month

KALEIDOSCOPE

You can generate some great graphics with these easy to type Archimedes listings. Short is often sweet!

Kaleidoscope (Listing 3) generates a series of patterns using the ellipse plotting command. Where it differs from other programs of this type is in the use of alternate banks of screen memory. The basic ideas behind this generator are:

1. Merging colours from successive plot commands.
2. Using clipping to allow for oversized patterns.
3. Using a sprite to transfer the patterns from the background to foreground screen.

The colour merging uses the standard 16 colour mode with random selections from the full palette. Colour 0 is, however, used for the backgound colour (this may also be changed to any other colour if required).

There are eight distinct pattern sequences each of which has three variations:

1. Normal
2. Radial
3. Lateral

These options describe the way the screens are constructed. Option 0 is a random combination of the other eight sequences and also has three variations.

Most important of these techniques is the use of a sprite to transfer the screens from background to foreground. This method was chosen for several reasons, including:

1. The ability to continuously update the background screen while using the foreground screen only for display.
2. Being strictly legal.
3. Using no obscure programming techniques.
4. Offering a simple method of clipping.
5. Its simplicity.

Very little has been said about the patterns used to illustrate the above techniques, but I think you will find them interesting in their own right.

Running

Listing 1 is a configuration program which you can setup with *BUILD SCON. To set up the required configuration type: *SCON <RETURN>, (only SCREENSIZE and SPRITESIZE are affected) and restart with <CONTROL><BREAK>.

Listing 2 is an initialisation program which you can setup with *BUILD PG. Type: *PG <RETURN> at the BASIC prompt to begin the Kaleidoscope program.

Listing 3 is the main Kaleidoscope program which should be saved as "RISC–WIDE".

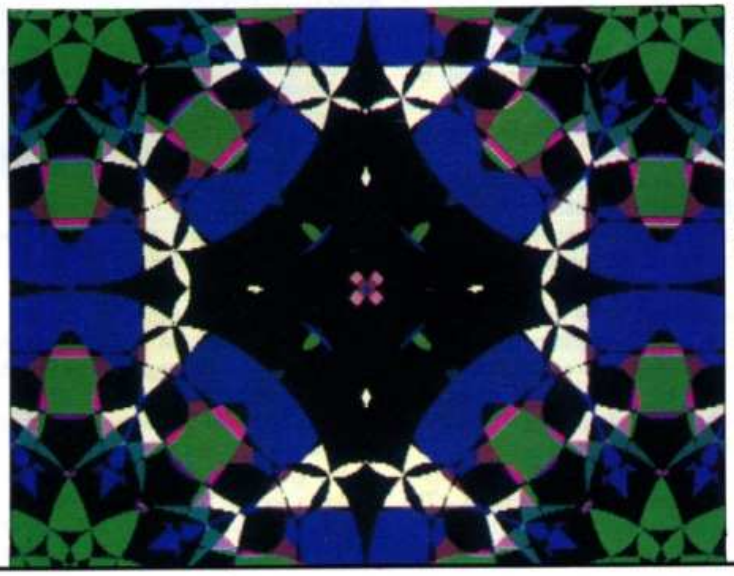
NB If the program is stopped by an <ESCAPE> the banks will still be in operation, therefore whatever is typed may be echoed. If there is no echo a *FX 113,0 should start the program.

Sting in the tail

All of the following six programs (Listings 4 to 9), which are designed to demonstrate the graphics capabilities of the Archimedes, have three basic sections:

1. Initialisation
2. Calculation
3. Plotting

The initialisation and plotting stages use standard techniques and the calculation stage involves a limited amount of trigonometry to describe the focus of the patterns. Have fun. If you don't have the time to do the typing then all the programs are available on DA4, the latest of our Archimedes 3.5" disks. See our advert in this issue.



The powerful colourful graphics capabilities of the Archimedes are used to create some amazing "doodle" patterns on the screen. Play on!

♦ LISTING 1 ♦

```
SCON

*CON. SCREENSIZE 20 *CON.
 SPRITESIZE 10
```

♦ LISTING 2 ♦

```
PG

*BASIC *KEY 1 EDIT |M
       *KEY 2 RUN  |M
       *KEY 3

*FX 112,0 |M LOAD
 "RISC_WIDE" RUN
```

♦ LISTING 3 ♦

```
   10REM > $.RISC_WIDE
   30REM WRITTEN BY LENNON TRA
IL.
   50       PROCinit(CNT%)
   60       PROCprompt(CHOICE$,
WEDGE,SCALE%)
   70       PROCbank
   90WHILE CNT% <= 99999
  120       PROCfirst_check(NUM
B%,CNT%)
  140       PROCdraw(NUMB%,SCAL
E%,CHOICE$)
  170       PROCscreen_draw(WED
GE)
  190       PROCblank_screen(CN
T%)
  210ENDWHILE
  220*CLOSE
  230END
  260 DEF PROCinit(RETURN CNT%

  270 LOCAL G
  280    MODE 12
  290    OFF
  300    G = RND(-13)
  310    ORIGIN 640,512
  320    GCOL 0
  330    COLOUR 128
  340    COLOUR 1
  350    VDU 19,0,24,240,240,12
8
  360    CLG
  370    CNT% = 1
  380 ENDPROC
  410  DEF PROCbank
  420          WAIT
  430          *FX 19
  440          *FX 9,0
  450          *FX 10,1
  460          VDU 23,1,0;
  470          *FX 112,2
  480           CLG
  500          *FX 112,1
  510         *FX 113,2
  520           CLG
  530    ENDPROC
  570DEF PROCprompt(RETURN CHO
ICE$,RETURN WEDGE,RETURN SCALE
%)
  580       LOCAL WEDGE$,ANS$
  590    PRINT TAB(19,10)  "THI
S PROGRAM ALLOWS FOR NINE SCAL
E OPTIONS"
  600    PRINT TAB(20,13) "ANY
OF WHICH MAY BE CHOSEN AT THIS
 STAGE"
  610    PRINT TAB(17,16)  "OPT
ION ONE GENERATES RANDOM SCALE
S WHEN REQUIRED"
  620    PRINT TAB(15,18)  STRI
NG$(52,"*")
  630    PRINT TAB(21,20) "ENTE
R THE SCALE REQUIRED [FROM 0 T
O 8]"
  640    INPUT TAB(31,23) "THEN
 PRESS RETURN      " SCALE%
  650    CLG
  670    INPUT TAB(20,13) "DO Y
OU REQUIRE ONE OF THE OTHER OP
TIONS Y/N  "ANS$
  680          IF ANS$ = "Y" THE
N
  690             PRINT TAB(17,1
6) "OPTIONS ARE :"
  700             PRINT TAB(27,1
8) "LATERAL   [L]"
  710             PRINT TAB(27,2
0) "RADIAL    [R]"
  720             INPUT TAB(17,2
3) "CHOOSE [L] OR [R]: PRESS R
ETURN  " CHOICE$
  730          ELSE
  740             CHOICE$ = "B"
  750          ENDIF
  760           CLG
  770          PROCclip_prompt(W
EDGE$,WEDGE)
  780ENDPROC
  800DEF PROCclip_prompt(WEDGE
$,RETURN WEDGE)
  810    PRINT TAB(21,16) "DO Y
OU REQUIRE TRIANGLE CLIPPING [
Y/N]"
  820          WEDGE$ = "Y"
  830    INPUT TAB(23,19) "PRES
S RETURN FOR THE DEFAULT ;YES
" WEDGE$
  840          IF WEDGE$ = "N" TH
EN
  850                WEDGE = FALS
E
  860          ELSE
  870                WEDGE = TRUE
  880          ENDIF
  890ENDPROC
  920 DEF PROCfirst_check(RETU
RN NUMB%,CNT%)
  930    IF CNT% = 1 THEN
  940       NUMB% = 3
  950    ELSE
  960       NUMB% = 10
  970    ENDIF
  980 ENDPROC
 1010  DEF PROCdraw(NUMB1%,SCA
LE1%,CHOICE1$)
 1020       LOCAL X%,Y%,R%,Z%,M%
,ANG%,ANG2%,ANG3%
 1030       LOCAL SCALE_RND1%,CC
OUNT%,SIZE%
 1050       Z% = RND(250)
 1060       M% = RND(250)
 1070       ANG% = 45
 1080       ANG2% = 90
 1090       SCALE_RND1% = RND(8)
 1110    FOR SIZE% = NUMB1% TO
1 STEP -1
 1120             IF SCALE1% = 0
 THEN
 1130                R% = 50 * S
CALE_RND1% * SIZE%
 1140             ELSE
 1150                R% = 50 * S
CALE1% * SIZE%
 1160             ENDIF
 1170       FOR E% = 1 TO 8
 1180                ANG3% = ANG%
 * E%
 1190                X% = R% * CO
S(RAD(ANG3% + 90))
 1200                Y% = R% * SI
N(RAD(ANG3% + 90))
 1220           CASE CHOICE1$ O
F
 1230             WHEN "L" : EL
LIPSE FILL X%,Y%,Z%,M%,RAD(ANG
3% - 90)
 1240             WHEN "R" : EL
LIPSE FILL X%,Y%,Z%,M%,RAD(ANG
3%)
 1250           OTHERWISE
 1260             ELLIPSE FILL
X%,Y%,Z%,M%,RAD(ANG3% - 90)
 1270             ELLIPSE FILL
X%,Y%,Z%,M%,RAD(ANG3%)
 1280             ELLIPSE FILL
X%,Y%,Z%,M%,RAD(ANG3% - 45)
 1290             ELLIPSE FILL
X%,Y%,Z%,M%,RAD(ANG3% + 45)
 1300           ENDCASE
 1310        NEXT
 1330         PROCset_colour(CC
OUNT%)
 1350     NEXT
 1360  ENDPROC
 1390 DEF PROCset_colour(RETUR
N CCOUNT%)
 1400     CCOUNT% = RND(15)
 1410     COLOUR CCOUNT% , RND(
255),RND(255),RND(255)
 1420     GCOL RND(7),CCOUNT%
 1430 ENDPROC
 1460    DEF PROCscreen_draw(WE
DGE)
 1470
 1480        MOVE -511,-511
 1490        MOVE 511,511
 1500        *SGET "PICT"
 1510        *SCHOOSE "PICT"
 1530        FOR XXX% = 1 TO 500
0
 1540          CVAL = 1.92929^10
 1550        NEXT
 1570        *FX 112,2
 1580         PLOT &ED,-1023,-1
023
 1590         PLOT &ED,0,-1023
 1600         PLOT &ED,-1023,0
 1610         PLOT &ED,0,0
 1620         IF WEDGE PROCwedg
e
 1622         *FX 112,1
 1660      ENDPROC
 1690DEF PROCtriang(A%,B%,C%,D
%,E%,F%)
 1700  GCOL 0,0
 1710  MOVE A%,B%
 1720  MOVE C%,D%
 1730  PLOT &55,E%,F%
 1740ENDPROC
 1770DEF PROCwedge
 1780    PROCtriang(-512,-512,-
512,-220,-220,-512)
 1790    PROCtriang(512,512,512
,220,220,512)
 1800    PROCtriang(512,-512,51
2,-220,220,-512)
 1810    PROCtriang(-512,512,-5
12,220,-220,512)
 1811    RECTANGLE FILL -640,-5
12,128,1024
 1812    RECTANGLE FILL 512,-51
2,128,1024
 1820ENDPROC
 1850DEF PROCblank_screen(RETU
RN CNT%)
 1860       LOCAL G
 1870     IF CNT% >  1 THEN
 1880     IF CNT% MOD 20 = 1 TH
EN
 1890    REM   G = RND((-CNT%/2
0)-1)
 1900       CLG
 1910     ENDIF
 1920     ENDIF
 1940     CNT%+=1
 1950ENDPROC
>
```

LISTINGS

♦ LISTING 4 ♦

```
  10REM > CRAZYDRAW5
  20G=RND(-3)
  30MODE 12
  40ORIGIN 640,512
  50R = 100
  60VDU 20
  70GCOL 128
  71*FX 10,50
  72*FX 9,50
  80CLG
  90R2 = 10
 100
 110REPEAT
 120SIZE = RND(5)+2
 130FOR R = 300 TO 300 STEP
-180
 140SHADE1% = RND(7)
 150FOR T = 0 TO 360 STEP 3
 160  X = R*COS(RAD(T))
 170  Y = R*SIN(RAD(T))
 180  FOR GG = 1 TO 15
 190    Y += R2 *
COS(RAD(T*SIZE))
 200    X += R2 *
SIN(RAD(T*SIZE))
 210    GCOL GG/2
 220  CIRCLE FILL X,Y,20
 221  CIRCLE FILL -X,-Y,20
 222  CIRCLE FILL X,-Y,20
 223  CIRCLE FILL -X,Y,20
 230  NEXT
 240NEXT
 250  TIME =0
 260  REPEAT UNTIL TIME
=1000
 270NEXT
 280  CLG
 290
 300UNTIL FALSE
 310END
```

♦ LISTING 5 ♦

```
  10REM > CRAZYDRAW4
  20G=RND(-3)
  30MODE 12
  40ORIGIN 640,512
  50R = 100
  60VDU 20
  70GCOL 128
  71*FX 10,50
  72*FX 9,50
  80CLG
  90R2 = 10
 100
 110REPEAT
 120SIZE = RND(5)+2
 130FOR R = 300 TO 300 STEP
-180
 140SHADE1% = RND(7)
 150FOR T = 0 TO 360 STEP 3
 160  X = R*COS(RAD(T))
 170  Y = R*SIN(RAD(T))
 180  FOR GG = 1 TO 15
 190    X += R2 *
COS(RAD(T*SIZE))
 200    Y += R2 *
SIN(RAD(T*SIZE))
 210    GCOL GG
 220  CIRCLE FILL X,Y,20
 221  CIRCLE FILL -X,-Y,20
 222  CIRCLE FILL X,-Y,20
 223  CIRCLE FILL -X,Y,20
 230  NEXT
 240NEXT
 250  TIME =0
 260  REPEAT UNTIL TIME
=1000
 270NEXT
 280  CLG
 290
 300UNTIL FALSE
 310END
```

♦ LISTING 6 ♦

```
  10REM > CRAZYSEND
  20G=RND(-3)
  30MODE 12
  40ORIGIN 640,512
  50VDU 20
  60GCOL 129
  70CLG
  80R = 320
  90R2 = 10
 100REPEAT
 110SIZE = RND(5)+2
 120SHADE1% = RND(50)
 130FOR T = 0 TO 90*RND(2)
STEP 3
 140  X =
(R+100)*COS(RAD(T))
 150  Y = R*SIN(RAD(T))
 160  FOR GG = 1 TO 15
 170    X += R2 *
SIN(RAD(T*SIZE))
 180    Y += R2 *
COS(RAD(T*SIZE))
 190    GCOL (GG + SHADE1%)
MOD 15
 200  CIRCLE FILL X,Y,20
 210  CIRCLE FILL -X,Y,20
 220  CIRCLE FILL -X,-Y,20
 230  CIRCLE FILL X,-Y,20
 240  NEXT
 250NEXT
 260FOR CNT% = 1 TO 2
 270  TIME =0
 280  REPEAT UNTIL TIME =100
 290  OSCLI "FX
"+STR$(9+((CNT%+1) MOD
2))+",0"
 300NEXT
 310  CLG
 320UNTIL FALSE
 330END
```

♦ LISTING 7 ♦

```
  10REM > DRAGON2
  20G=RND(-3)
  30MODE 12
  40ORIGIN 640,512
  50R = 100
  60VDU 20
  70GCOL 128
  80CLG
  90R2 = 10
 100
 110REPEAT
 120SIZE = RND(5)+2
 130FOR R = 250 TO 250 STEP
-180
 140SHADE1% = RND(7)
 150FOR T = 0 TO 360 STEP 1
 160  X = R*COS(RAD(T))
 170  Y = R*SIN(RAD(T))
 180  FOR GG = 1 TO 25
 190    X += R2 *
SIN(RAD(T*SIZE))
 200    Y += R2 *
COS(RAD(T*SIZE))
 210    GCOL GG
 220  CIRCLE FILL X,Y,20
 221  CIRCLE FILL -X,-Y,20
 222  CIRCLE FILL X,-Y,20
 223  CIRCLE FILL -X,Y,20
 230  NEXT
 240NEXT
 250  TIME =0
 260  REPEAT UNTIL TIME
=1000
 270NEXT
 280  CLG
 290
 300UNTIL FALSE
 310END
```

♦ LISTING 8 ♦

```
  10  REM > DRAGON4
  20G=RND(-3)
  30MODE 15
  40ORIGIN 640,512
  50VDU 20
  60GCOL 128
  70CLG
  80R = 75
  90R2 = 10
 110REPEAT
 120SIZE = 7
 140BASE% = RND(48271)
 150FOR T = -10 TO 37 STEP 1
 160  X = R*COS(RAD(T))-30
 170  Y = R*SIN(RAD(T))
 180    XX = R2 *
SIN(RAD(T*SIZE)) +10
 190    YY = R2 *
```

LISTINGS

♦ LISTING 9 ♦

```
COS(RAD(T*SIZE)) +10
  200    WAIT
  210  FOR GG = 1 TO 25
  220  X += XX
  230  Y += YY
  240    GCOL (GG * BASE%) MOD
63
  250  CIRCLE FILL X,Y,20
  260  CIRCLE FILL -X,-Y,20
  270  CIRCLE FILL X,-Y,20
  280  CIRCLE FILL -X,Y,20
  290  NEXT
  300NEXT
  310  TIME =0
  320  REPEAT UNTIL TIME =500
  340  CLG
  350
  360UNTIL FALSE
  370END
```

```
  10REM > SPIDER_2
  20G=RND(-3)
  30MODE 12
  40ORIGIN 640,512
  50R = 200
  60VDU 20
  70GCOL 135
  80CLG
  90R2 = 40
 100R3 = 40
 110REPEAT
 120SIZE = RND(7)+4
 130FOR R = 390 TO 210 STEP
-60
 140SHADE1% = RND(7)
 150FOR T = 0 TO 360 STEP .1
 160  X = R*COS(RAD(T)) -
(R2) * SIN(RAD(T*SIZE))
 170  Y = R*SIN(RAD(T)) -
(R2) * COS(RAD(T*SIZE))
 180  GCOL  SHADE1%
 190  CIRCLE FILL X,Y,5
 200NEXT
 210R2 =R2+40
 220NEXT
 230R2=40
 240  TIME =0
 250  REPEAT UNTIL TIME =100
 260  CLG
 270UNTIL FALSE
 280END
```


Archimedes

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Gordon Taylor

Archimedes REPORT

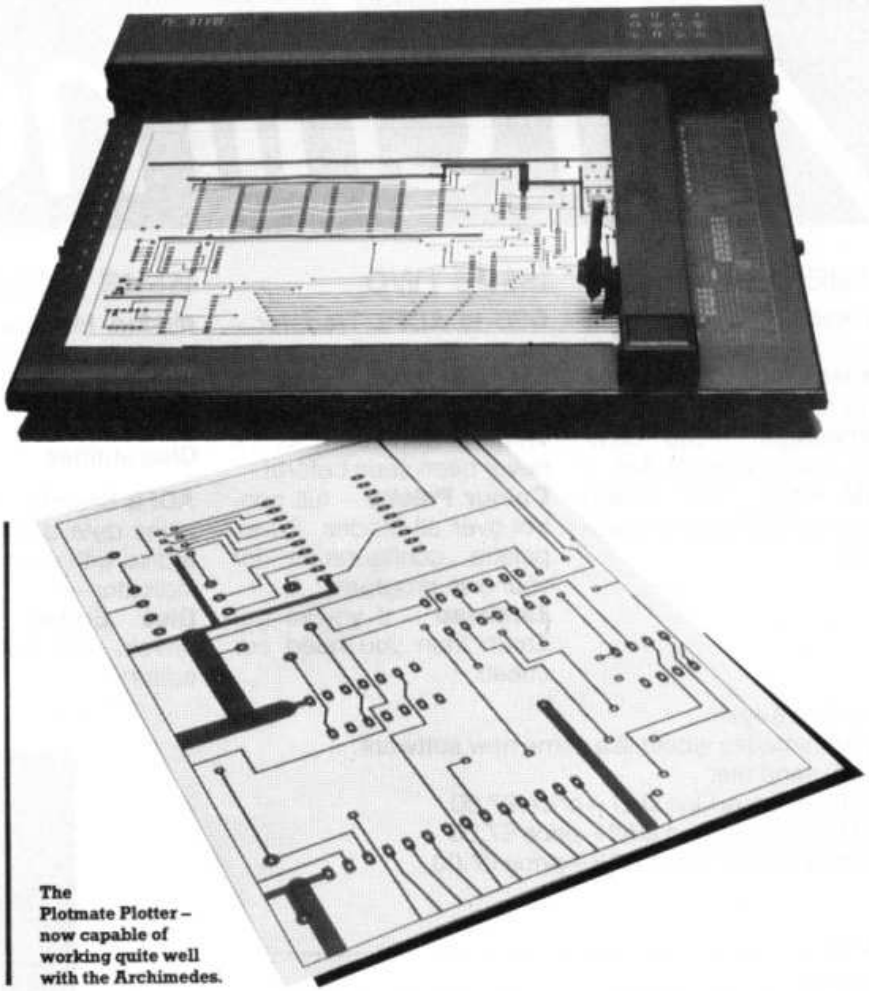
A solution for laying out Printed Circuit Boards, and producing the Artwork

Introduction

For this report I have looked at two products for the Archimedes that may be used together – the Lintrack printed circuit board (PCB) design package, and the Plotmate A4SM Multi-pen plotter – both from Linear Graphics Ltd (LGL). Lintrack is a computer-aided design (CAD) package with just the features necessary for laying out PCBs – ie components, labels, (solder) pads, and tracks. With this package, the Plotmate A4SM and A3M plotters can produce outline plots in several colours for checking the design, and then final artwork, either actual-size or enlarged, for the tracking, for templates for cutting the profile and drilling the holes, and for printing the component decriptions on the PCB.

There are many packages (running on various computers), for producing two-dimensional drawings (eg for architecture and engineering), which could in principle be used for PCB layout. However, there are far fewer which are specialised for PCB layout. Although Lintrack has all the features needed for a dedicated PCB layout package, it does not have all those of a general-purpose CAD package. This reduces the size of the program, so leaving more space for data, Moreover, it minimises the number of options, with their screen menus or keys, and hence the risk of confusion – especially for the novice or occasional user.

Lintrack is not intended for, nor capable of, drawing schematic diagrams of electronic circuits. For such diagrams, LGL offer Lintronic, which runs on the Model B/Master Series. Moreover, Lintrack has no "intelligence" of its own, for the automatic routing of tracks, which is found in larger (and much more expensive) PCB layout packages. However, LGL have noted the requirement, and hope to offer a package (also for the Archimedes) with this capability in the future.



The Plotmate Plotter – now capable of working quite well with the Archimedes.

Lintrack

Lintrack Archimedes is derived from earlier versions written for the Model B/Master, the IBM-PC and compatibles, and the RM Nimbus. The three versions are compared in Fig 1. Compared with the Model B/Master version, the PC and Arc versions can handle progressively larger PCBs. For the Arc version, the largest PCB is, for example, larger than the double-height Eurocard needed for the largest Arc podules. Indeed, it is larger than the Arc motherboard. For a single Eurocard of 3.9 by 6.3 inches, you can reckon on some 2000 items. Hence 5000 should be more than enough for most projects. In any case, the trend is to fewer individual components, with ever-higher degrees of integration. The Archimedes has also allowed other features to be enhanced compared with earlier versions. Moreover, where the Model B/Master version was written in BASIC and Assembler, and the PC version in Turbo Pascal, the Arc version is written in Acornsoft "C", and re-draws the screen up to five times as fast when showing the whole layout. This advantage may be doubled when re-drawing partial views, for which the data requires "clipping". (See Fig 2).

Lintrack Archimedes will run in a 305, but only after *UNPLUGing a system module (eg the Windowmanager), and it cannot use a 512-line display, such as Mode 20. The RMASize should be 3 ie 24 K. However, a 310 or 410 has enough RAM without unplugging any system modules, even with the ScreenSize set to 20 ie 160

K, for Mode 20. Lintrack requires Arthur 1.2 or later. Instead of the Arc mouse, you could if you prefer, use the Marconi Trackerball (costing £69.52 plus VAT), connected to the mouse socket with a special lead (costing some £15).

Along with the data for the current layout, the Lintrack program is all held in memory, and uses no overlays. Hence, after loading, the program disc can be removed, and replaced by a data disc, carrying the component library and layout files. This means that it will work perfectly well with even a single floppy disc drive. Thus, there is no need for a Winchester hard disc- although the greater capacity and speed is always an added convenience.

Because Lintrack is written in a compiling langauge (as opposed eg to BBC BASIC and ARM Assembler), additional software or hardware is needed to support floating point calculations. For 300-series machines, this must be an Acorn Floating Point Emulator, as supplied on the Arc Welcome disc. However, for 400-series machines, a hardware Floating Point Unit will soon be available (at extra cost), which will enable Lintrack to run faster still.

For screen display, Lintrack Archimedes supports both the 256-line modes, which require only the standard Acorn/Philips colour monitor (or equivalent), and the 512-line modes, which require a multi-frequency monitor. This allows the PCB layout to be displayed at twice the vertical resolution, which gives greater sharpness and clarity. However, since Lintrack is a true object-based drawing package, the resolution of the final artwork does not depend on the screen mode, but almost entirely on the plotter.

As output devices, Lintrack Archimedes supports no printers, but only the Plotmate A4SM and A3M plotters. These are the "smart" versions, which contain their own micro-processor and ROM, as needed for use with the Arc. Lintrack Archimedes outputs data in the BBC "VDU stream" format, which these plotters can accept, so that no "HPGL" or other emulation ROM is required.

Lintrack can plot outlines of several layers in succession in different colours, and so can benefit from automatic pen changing. While the LGL multi-pen adaptor comes with instructions for fitting and adjustment, the procedure is quite complicated. To ensure satisfactory performance, it is better fitted at the factory, or by a Plotmate dealer. Where the single-pen Plotmates normally use pens with bayonet fixing, the multi-pen adaptor uses Hewlett-Packard (H-P) plotter pens. These are an industry-standard for multi-pen plotters, and are available from LGL and elsewhere.

LINTRACK SPEEDS			
	Times in seconds		
Layout of 4000 items	Master 128	PC 1512	Archimedes
Screen re-draw - 1x	11.5	20	4
Screen re-draw - 2x	39.5	17	4
Screen re-draw - 4x	13	25	3
Screen re-draw - 8x	6.5	14	3
Screen re-draw - 16x	-	-	3
Set Area Group	468	30	4

Using Lintrack

Lintrack is controlled by a combination of screen menus, with options selected with the mouse or key letters, and function keys. This allows control almost wholly via the mouse, or by the keys, or any mixture of the two. One such is to use keys (with the left hand) for menu selection, and the mouse (with the right hand) for drawing etc. The menu map is shown in Fig 3, and the key commands are mentioned below.

The Left button of the mouse acts as Return, so you can move over the whole drawing area – even when showing only a part at once. When the cursor reaches the edge of the screen window, you press Return or the Left button, and it is re-drawn with that point in the centre. The Middle button acts as Escape, and toggles between the drawing and menu areas (and back), while leaving the editing cursor in position. The menu highlight (a box around the option name) may then be moved up and down with the mouse. The Right button acts as the Space Bar, for altering (or adjusting). These button functions are thus consistent with the Acorn convention of Select, Menu, and Adjust respectively. When prompted for Yes/No, the Left button acts as "Yes", and the Middle button as "No".

You can select any part of the drawing area for viewing, by positioning the cursor on it, and pressing one of the function keys f1 to f5, to redraw it centered, and at a Scale (or Zoom factor) of 1x to 16x respectively. f9 centers the cursor on the drawing area at a Scale of 1x, while f8 toggles between screen displays which show tracks as double lines with end arcs (the default), or as single lines – which more than doubles the speed of re-drawing, and increases the clarity of the display. Pressing "R" may be used to redraw the screen, without changing the view or the Scale. This allows you to clean the drawing area of any "odd bits" resulting from drawing and deleting etc.

Design Layout

Most of the screen is drawing area, and Lintrack starts by showing the whole, representing 20 x 18 inches, at a Scale (or Zoom factor) of 1x. On the right is an area for menus and sub-menus. The "Screen" option toggles between 80- (the default), and 40-column modes, to allow the use of monitors with high and low resolution. The various layers, and their colours are: 0 (solder side, bottom)- red, 1 (component side, top)- green, 2 (PCB profile, or clearance)- blue, 3 (labels- ie component identification)- cyan. You can use layer 2 for tracks etc (eg for a PCB with more than two layers of tracking. f7 allows you to select which layers to display- 0 to 3, or Return for all four. When only a single layer is being displayed, the layer number is shown in the corresponding colour.

As well as the drawing area and the current menu or sub-menu, the screen display includes:- information specific to the current option, such as status messages, and the current label text, or pad or track size.- the Scale (or Zoom factor), from 1x to 16x, selected via the function keys f1 to f5.- the X and Y co-ordinates of the drawing cursor (in inches). This version of Lintrack works only in inches, in line with the standard practice in PCB design. The Pad and Track sizes are expressed in "thous"- ie thousandths of an inch.- Tot n % is the total number of items in the current layout, as a percentage of the capacity of 5000. The number below is the actual number of items.

LINTRACK VERSIONS			
	Model B/Master	PC/Nimbus	Archimedes
Max width of PCB - in	10.23	19.20	20.00
Max height of PCB - in	10.23	14.40	18.00
Max number of items	2000 to 8000	5000	5000
Track widths	6	8	8
Pad sizes	6	8	8
Number of layers	4	4	4 (+2)
Colours - 80 columns	2	2/4	up to 16
Colours - 40 columns	4	4/16	up to 16
Zoom factors	1x to 8x	1x to 8x	1x to 16x

Create

You start by selecting an item with which to draw. A layout is made up of only four types: Pads (which are circular or elongated, in one of eight sizes), Labels (of up to four characters), Comp(onents) (which are linear arrays of Pads, and may have a Label), and Tracks (which are straight lines, in one of eight widths). Pads may be from 50 to 200 thou in diameter, plus 2 elongated, and Track widths from 15 to 200 thou. You can step through the ranges of sizes of Pads and Tracks by clicking the Left button or using the "+" and "-" keys.

A guidance grid of dots, with a spacing that varies with Scale, from 1.0 to 0.1 inch, may be turned on (or off) by pressing "G". By clicking the Left button, or pressing Return, the currently selected item can be copied to the current cursor position, subject to the current drawing or "Snap" grid. Tracks are drawn with "rubber-banding", so may be at any angle, but the Snap grid makes it easy to draw horizontally and vertically when required. When the cursor shows as an upright cross (the default), the Snap grid pitch is 0.05 in. By pressing the Space Bar or Right button, the cursor changes to a diagonal cross, and the Snap grid pitch is reduced to 0.01 inch. You can set a temporary origin by pressing "O", which puts "Offset" on the screen. This allows you to move or draw relatively – eg to place two pads 0.5 inches apart. The last item placed can be erased by pressing the "Delete" key. To delete more than one item, you have to select an Area Group (see below).

Edit

Edit operates on an existing layout, so requires that some (or all) items be selected or "picked". This may be done one at a time, by clicking on or near it, and responding to the prompt "Accept ? (Y/N". Alternatively, selecting the Area Group option puts a box on the screen (centered on the cursor), which can be adjusted in width and height, using keys or the mouse. While the default is to include only those items contained wholly within the box, selecting "External" includes those items with anything (eg even only one end or pad) inside.

You can then select either "AllGroup" for everything in the box, without individual confirmation, or "Group" – whereupon each item in turn flashes, and the message "Picking", and the prompt "Accept ? (Y/N)" appears. Once the required items have been picked up, they can be moved around and "dropped", duplicated (or copied), rotated, flipped about the "Y-axis", erased (with confirmation), or altered (in size, layer, or Horizontal or Vertical orientation). A particularly powerful feature of Lintrack Archimedes is "Pull". This operates on a group, with "External", and allows the selected items to be moved together, while "rubber-banding" all the associated tracks. Editing involves repeated re-drawing of part of the layout, for which the speed of the Arc version – at five to ten times that of the PC version – is particularly valuable.

PCBs are used to hold standardized components – such as connectors and Integrated Circuits (ICs) – hence PCB layout packages usually have libraries of such components already defined. The component library supplied with Lintrack contains 17 items, including all the common Dual-In-Line (DIL) sizes, (Centronics) Parallel and D-type connectors, and pads for individual transistors. It does not include pads for individual resistors and capacitors, since these comprise only two pads, which may be entered using Comp (see above). However, users can also define their own components.

A Group of items may be saved to disc, each with their own X- and Y-offsets. This can be anything from a single pad to a complete PCB layout. An extension library of surface-mount devices is being developed, and will be available soon. When a component is loaded to the cursor, it is still free to be moved, duplicated, rotated, and flipped, and is only fixed when you select Drop (or Exit). This feature can even be used to import part or all of another layout. Text strings of up to 20 characters can be added, in sizes from 1 (= 0.06 in) to 10 (= 0.6 in) high. This is intended for legends, to accompany the component labels, which are to be printed on the PCB.

Files

In addition to the usual options to catalogue a directory, and load or save a file, the Files menu includes an Operating System "window" (shown as "Arthur"). This allows eg discs to be mounted in drives, directories to be changed, and files to be copied, renamed, and deleted. However, *BACKUP and *COMPACT should be avoided, as should the Quick option when copying, since they will corrupt the data area, and you will lose your layout! The Arthur "window" may also be used to adjust the "beep", by entering *VOLUME n – where the maximum (and default) is n=127, and the minimum is n=1.

```
                    LINTRACK     MENU      MAP

Design layout  Design       Create          Track
                                            Pad
                                            Comp(onent)
                                            Label
                                            Layer
                                            Exit
                            Edit            Move
                                            Drop
                                            Alter
                                            Pull
                                            Set Area Group  Width +/-
                                                            Height +/-
                                                            Group
                                                            Allgroup
                                                            External
                                                            Exit
                                            Erase
                                            Edit2           Save to file
                                                            Load tb cursor
                                                            Duplicate
                                                            Rotate (90 deg.
                                                            Flip (about Y)
                                                            Text entry
                                                            Catalogue
                                                            Exit
                                            Exit
                            Files           Drive
                                            Catalogue
                                            Dload
                                            Save
                                            Arthur
                                            Exit
                            Screen (40/80)
Plot layout                 Plot            Plot            A3/A4
                                                            Layers
                                                            Flip (On/Off)
                                                            Pen size
                                                            Artwork/Outline
                                                            Go
                                                            Re-start
                                                            Exit
                                            Files (as above)
                                            Test plotter
                                            Exit
                            Exit

Select plotter
Exit package
```

Plot

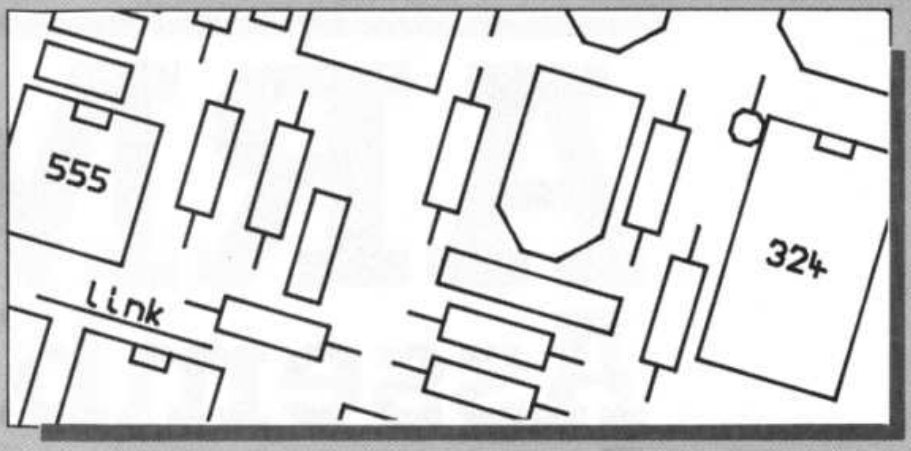
On entering "Plot", a box corresponding to the currently selected paper size shows on screen, and may be positioned relative to the layout with the mouse or cursor keys. Plots may be either of "Outlines", often with more than one (up to all) layers at once, for checking, or "Artwork" (ie with filled pads and tracks, which take much longer to plot), with one layer at a time. The layers may be 0 or 1 (tracking), 2 (profile template), 3 (labels, for silk-screen printing), or 4 or 5 (the pads only of layers 0 and 1, for drilling templates). Artwork can be either plotted on film at 1x, for direct use, or plotted on paper at 2x, 4x, or 8x, for camera-ready artwork,

which is photo-reduced for use. You can change the scale of the plot from 1x to 8x, via the function keys f1 to f4, and again the size of the plotting window changes accordingly.

The Plot menu also allows you to select: the paper size as A3 or A4 (in the case of an A3 plotter), whether the plot should be Flipped (as may be necessary for the Artwork of layer 0 – the underside of the PCB), and the pen size as 0.3 or 0.7 mm, (which determines how closely the pad and track filling lines need to be drawn). When these have been selected, plotting may be started with the "Go" option. The item number resets to 1, and then clocks up as they are plotted, skipping those which are not on the selected layer(s), or lay outside the "plot box". If you want to answer the telephone etc, you can always take the plotter off-line, but you can also pause at any point by pressing the Space Bar, (which puts a message on the screen), and re-start by pressing it again. Alternatively, plotting may be terminated at any point (eg because a pen ran out), by pressing Escape or the Middle button. Selecting the menu option "Restart" allows you then to re-commence from any item number.

Where on the Model B/Master and PC versions, pads and track ends were octagonal, on the Arc version, they are (semi-)circular, and thus less likely to cause solder whiskers during manufacture. An artwork plot of tracking (layer 0), flipped to suit the underside, is shown in Fig 4. This took 31 m 41 s to plot, whereas an outline or draft version took only 12 m 22 s. A plot of the component descriptions (layer 3), for printing on the PCB (usually by silk screening), is shown in Fig 5, which took 3 m 50 s. The quality of the artwork depends on the Lintrack software, the correct choice of pens and media (paper or film), and the accuracy and repeatability of the plotter.

For the Plotmate A4SM and A3M, the former is about +/- 0.004 in, and the latter +/- 0.002 in, which compares favourably with the minimum track width of 0.015 in. Moreover, Lintrack enables the impact of the accuracy and repeatability of the plotter to be reduced by plotting at more than full size, and photo-reducing the final artwork. A utility will be available shortly for converting Lintrack layout files to the Gerber format, which is the industry-standard for photo-plotters.



Documentation

The manual comes in a ring-binder with A5 pages. It is based on those of the earlier versions, and has both tutorial and reference sections. Some advice on the choice of pens and media is included.

Discussion

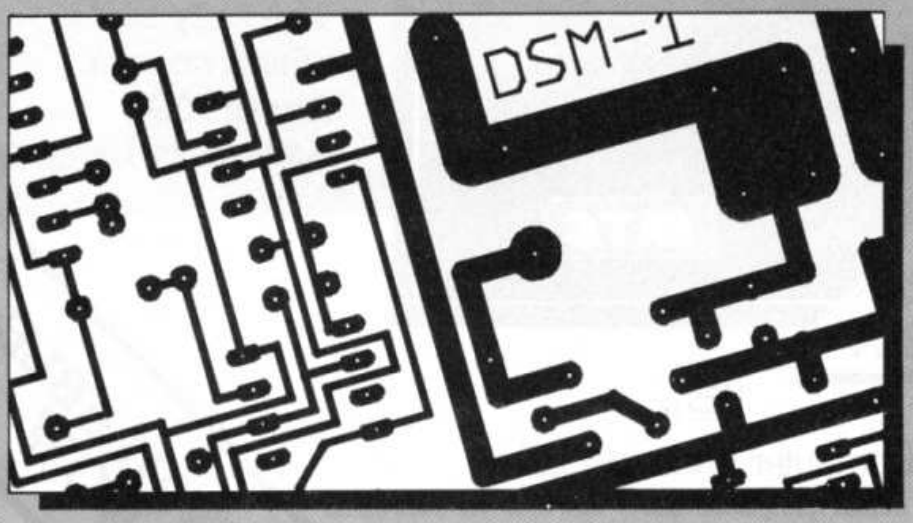
Lintrack Archimedes is normally priced at £160, plus VAT, but is available at a discount to educational purchasers. While higher priced than is usual in the Model B/Master market, it is still less than other general-purpose CAD packages (eg Bitstick, and Compas), and is competitive with software prices in the PC market. Although Lintrack is available in versions for the 8-bit Model B/Master, and 16-bit machines, such as the IBM-PC and the RM Nimbus, the Archimedes is far more suitable, since it has a 32-bit processor – as in most engineering workstations. This enables it to run up to five to ten times as fast ! Moreover, the Arc version allows the use of colour (to distinguish the layers) – even at the highest resolution. Indeed, when used with a multi-frequency monitor, the screen display of Lintrack Archimedes has a resolution higher than the EGA of a PC, the Nimbus PC-186, and the VGA of the new IBM PS/2 machines.

The LGL Plotmate A4SM is priced at £500 and the A3M £640, both plus VAT. Both may be fitted with automatic multi-pen handling, costing an extra £132, plus VAT. In addition, an "HPGL" ROM may be fitted, enabling it to emulate the H-P 7470A or 7475A plotters, for use with other applications. This is priced at £40, plus VAT. Again educational discounts are available.

The suitability of Lintrack and the Archimedes for PCB layout has been confirmed by their acceptance for one of the "packs" under the current Department of Trade and Industry (DTI) scheme for schools. The DTI "pack" also includes the Clares' Artisan "painting" package, the LGL Welcome Pack (with four other applications, and three examples, which may be output to a plotter), and a Plotmate A3M plotter, with automatic multi-pen handling. Acorn and LGL are now shipping their contributions to these "packs" in quantity.

Conclusions

Lintrack running on the Archimedes, and outputting to a Plotmate plotter, is an excellent example of a complete solution-in this case for laying out Printed Circuit Boards (PCBs). Lintrack is very easy to use, thanks to the carefully chosen features, and the flexibility of control via the mouse and/or keys. The Archimedes ensures that the response to the mouse is very positive, and the screen update is notably fast. Either of the Plotmate multi-pen plotters can produce quick outline plots for checking, and high quality artwork for the tracking, the profile and drilling templates, and the printed component descriptions of PCBs. These merits have been recognised by their inclusion in one of the DTI "packs". As further proof, Linear Graphics are using Lintrack for their own in-house PCB layout work. Moreover, with the greatly increased scope offered by the Archimedes, they expect to produce enhanced versions in the future.



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By Peter Cockerell

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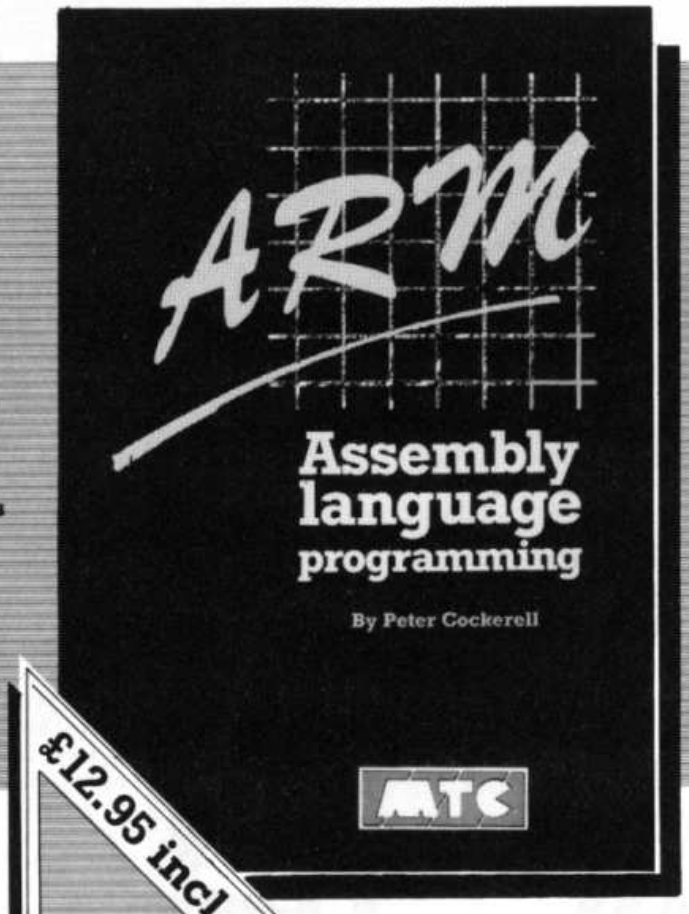

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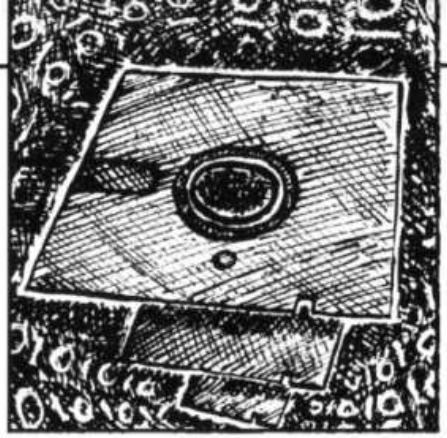


Paul Fellows

PROGRAMMING THE ARM

Introducing the ARM Assembler

For the BBC BASIC programmer, the Archimedes appears little different to its predecessors. It is certainly faster, and some useful extra BASIC keywords have appeared, but on the whole it remains compatable with most existing BBC BASIC software.

For the assembly language programmer, however, life has changed; Instead of containing the 8-bit 6502 processor, the Archimedes contains a 32-bit Acorn-designed RISC chip called the ARM. This brings with it a whole new instruction set and method of programming.

RISC stands for *Reduced Instruction Set Computer*. Generally people think this implies that only a few simple instructions exist, each of which does very little. This is true but it is incorrect to conclude that RISC puts more of a burden onto the programmer. In fact quite the opposite is observed. Whilst more instructions are needed than you might have to write on a 80386, the simplicity of the instructions means that you can remember the rules about what they do. Consequently the amount of time spent desperately thumbing through the manual looking for the instruction which comes closest to doing just what you want is reduced. (As is the size of the manual!)

Perhaps a better way of looking at it is that having a RISC machine means that you get a few general purpose instructions. (And by implication no special purpose ones.) To understand this, we will need to look at the ARM CPU and at how its various features combine to make a simple, easy to drive, powerful processor.

The ARM CPU

Without going into the gory detail about the hardware, there are a few points to note about the CPU.

- It has 32 data pins.

This means that it can move data into or out of the chip 32 bits (4 bytes) at a time. Since it is clocked at a speed of 8MHz (mostly) this means that it can throw data around at a peak rate of 4*8 Mbytes/second i.e. 32 Mb/s. Compare this with the 2MHz 6502 which can only move 1 byte in or out at a time (which is why it is called an 8-bit processor). Clearly we should expect the ARM to go about 16 times faster!

- It has 26 address pins.

This means that it can address 2 to the power of 26 bytes of memory (ie. 64 Mbytes) which is 1024 times as much as a 6502.

Less visible, but just as important, are the registers inside the chip. Each can hold 32 bits of information and there are 26 in total. However, only 16 of them are of concern to us. The others are not available most of the time; they are only accessible when dealing with interrupts or other operating system related tasks.

The Instruction Set

Enough of the generalities about the chip, let's move onto the instruction set. We know that the instruction set is reduced, but just how many instructions does that give you? This is a hard question to answer because all the instructions come in a number of forms so it depends on what exactly you define an instruction to be. Table 1 shows the minimum list and these are dealt with in categories below. One fact which is common to them all is that the instructions are all 32 bits longs, no extension words are used.

```
Table 1 - The ARM instruction Set

Arithmetic instructions

Register moves

MOV    Move
MVN    Move not

Adds, subtracts and bitwise instructions

  ADC  Add with carry
  ADD  Add without carry
  SBC  Subtract with carry
  SUB  Subtract without carry
  RSC  Reverse subtract with carry
  RSB  Reverse subtract without carry
  AND  AND
  BIC  AND NOT
  ORR  OR
  EOR  Exclusive OR

  Comparisons

  CMN  Compare negative
  CMP  Compare positive
  TEQ  Test equal
  TST  Test

  Multiplication instructions

  MUL  Multiply
  MLA  Multiply and accumulate

Branching instructions

  B    Branch
  BL   Branch and link

Load/store instructions

  LDR  Load register
  STR  Store register
  LDM  Load multiple registers
  STM  Store multiple registers

Software interrupts

  SWI
```

Register moves

The instruction MOV copies a value into a register. MVN is similar but it inverses the value before placing it into the destination register. In their simplest form, the value used is an immediate constant, for example **MOV R0, #&10** places the value &10 (16) in register R0.

Alternatively the contents of another register may be copied instead as in **MOV R0, R1**.The contents of this register can be "shifted" or "rotated" by a number of places before it is copied, for example **MOV R0, R1 LSL #4** copies the contents of R1, shifted left by four places into R0. If you are unfamiliar with the concept of shifts and rotates see Diagram 2. One particularly useful feature of the ARM is that it contains a very clever piece of circuitry called a "barrel shifter". This enables the data in registers to be shifted or rotated round by any number of places all within one clock tick. Consequently, shifting the contents of the source register before moving it to the destination register takes no extra time to execute. Other CPUs typically can shift at a rate of only one place per clock tick.

Adds, subtracts and bitwise instructions

These take the contents of a source register, performs the appropriate action between these contents and either a constant, the contents of a second source register or the contents of a second source register shifted by a number of places and places the result in a destination register. For example:

SBC R0, R1, R2

subtracts the contents of R2 from R1 and places the result in R0.

One point to note about the ARM is that these instructions can be used to update the contents of a register by making the destination register the same as a source register. For example:

ADD R0, R0, #1

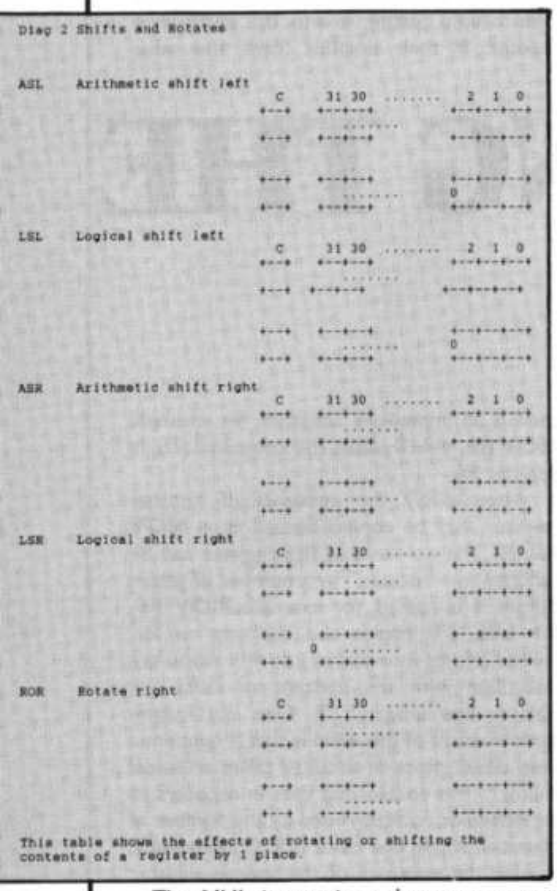
increases the contents of R0 by one. Alternatively, a different register can be given for the result, as in the first example above, in which case the source register(s) remain unchanged by the operation.

Comparisons

These are identical to the simple arithmetic and bitwise instructions except that the

result they produce is thrown away rather than being placed in a destination register. Their whole purpose is to set or clear particular flags within the processor so that subsequent commands may make use of them. Details on these flags and how they may be used are given later.

Multiplication instructions


Diag 2 Shifts and Rotates
ASL Arithmetic shift left
LSL Logical shift left
ASR Arithmetic shift right
LSR Logical shift right
ROR Rotate right
C 31 30 2 1 0
This table shows the effects of rotating or shifting the contents of a register by 1 place.

The MUL instruction takes two source registers, multiplies their contents together and places the result in a destination register. MLA is similar, it performs the additional step of adding the contents of a third source register to the product. For example

MUL R0, R1, R2
;R0 = R1 * R2 MLA R0, R1, R2, R3
;R0 = R1 * R2 + R3
(; denotes the start of a comment.)

One thing to note is that, unlike the other instructions met so far, they only act upon simple registers, not immediate values or shifted registers

These instructions are not truly RISC instructions and in fact were not present in the earlier (3 micron) version of the CPU released in the original development systems. They were added because they were felt to be useful and sufficient space existed on the circuit board for them.

As a consequence the symmetry which is present for all the other instructions does not extend to MUL and MLA. A restriction exists which dictates that the first source register must not be the same as the destination register. This is never a problem because multiplication is a commutative process and so you can just swap the order around. For example

MUL R0, R0, R1

is not allowed, but

MUL R0, R1, R0

is, and produces the required result since **R0 * R1 = R1 * R0**.

Flags and condition codes

As we saw above, the comparison instructions' whole purpose in life are to set or clear particular flags within the processor so that subsequent commands may act upon them. There are four flags which they can affect

NNegative flag
ZZero flag
CCarry flag
VOverflow flag

These flags are all automatically updated as a result of either an CMN or CMP and all but the overflag flag are affected by TEQ and TST.

The flags can also be optionally updated depending on the result of any of the other arithmetic instructions by placing an "S" at the end of the opcode. For example

ADCS R0,R0,R1

The advantage of this isn't so much that the flags can be set when required, it is that you can choose not to set them as a result of an arithmetic instruction. This means that they can be preserved over several instructions and safely referred to several times. By contrast, different 6502 instructions would update various subsets of the flags whether you wanted them to or not so producing unwanted side affects.

Using the 6502, the only way to respond to the flags is by using a branch instruction. All other instructions are executed whatever the state of the flags.

On the ARM, all instructions can be performed conditionally. There are 16 condition codes which may be used which are listed in Table 3. The default code is AL so unless otherwise specified, instructions are always executed regardless of the flag settings. Note the NV code, this converts any instruction into a no operation. – The ARM has rather a lot of NOPs!

Branching instructions

Although, arithmetic instructions can be performed conditionally, branch instructions are still useful when large amounts of code are to be bypassed. The simple branch instruction consists of the single letter "B" followed by any of the condition codes and the label to branch to.

● Note that the 6502 jump instruction "JMP" is achieved by a branch always, i.e. "BAL" or simply "B". For example

B label Jump (always) to label

Subroutines and Branch-and-Link

The essence of a subroutine call is that the processor jumps to the start of the subroutine, excecutes it and then returns back to the main program and carries on where it left off. To do this it needs to remember the place in memory to return to. This will be the address of the instruction which follows the subroutine call instruction. The 6502 handles this automatically with a pair of instructions. JSR (Jump-to-Sub-Routine) which saves the return address and RTS (ReTurn-from-Subroutine) which retrieves this address.

The ARM does not have an instruction which is the direct equivalent of the 6502's JSR instruction for calling subroutines. Instead it provides "Branch-and-Link" or BL for short. The difference is that the 6502 saves the return address on its stack whereas the ARM puts the return address into one of its registers – R14. This means that the 6502 can call many subroutines on top of each other so long as there is room on its stack for the return addresses. The ARM can only (automatically) handle one level of subroutine call because R14 can only hold one return address.

To return from a subroutine all that needs to occur is that this value gets copied into the program counter. What is the program counter on the ARM? Answer – register

Table 3 Conditions codes

Code	Flags	Description
AL		Always
CC	c	Carry clear
CS	C	Carry set
EQ	Z	Equal
GE	NV or nv	Greater than or equal
GT	NVz or vcz	Greater than
HI	Cz	Higher unsigned
LE	Nv or nV or Z	Less than or equal
LS	c or Z	Lower or same unsigned
LT	Nv or nV	Less than
MI	N	Negative
NE	z	Not equal
NV		Never
PL	n	Positive
VC	v	Overflow clear
VS	V	Overflow set

NZCV mean that the flags must be set and nzcv mean that they must be clear

number 15. Thus to return from a simple subroutine no special instruction is needed it is just MOV R15,R14.
So the 6502 code:
JSR routine1 .routine1 RTS
translates into
BL routine1 .routine1 MOV R15,R14

Load/store instructions

The arithmetic instructions are not much use unless you can copy data between registers and memory. The simplest way to so this is to load or store one register at a time.
For example **LDR R0, [R1]**
This loads R0 with the value held at the address held by R1.

If you like, the value held in R1 can have another value added to it before it is used as the address, for example
LDR R0, [R1,#4]

loads the value from the contents of R1 + 4.

The offset can be a register instead of a constant – very useful for looking things up in a table – and you can even specify that the offset is to be shifted before it is used. For example
LDR R0, [R1, R2, LSL #2]
loads the value from the contents of R1 + the contents of R2 shifted left by two places. This would be used when R1 pointed to the start of a table of 4-byte objects and R2 contained the index number for the entry in the table.

If the bracket only holds the register and the rest of the instruction is outside of it, for example
LDR R0, [R1],#4
then the address used is given solely by the contents of R1. The offest is not used for the transfer of the data. Instead it is added to R1 AFTER the data has been loaded. This is very useful for stepping on through a list of items.

Instead of transfering whole 32-bit words you can move things one byte at a time by using the "B" option. For example
STRB R0,[R1]

Multiple Register Transfers

The instructions LDM and STM allow you to load or store the contents of several registers at a time. This is much faster than only doing one at a time. For example
LDMIA R10,{R0,R1,R2,R3,R4,R5,R6,R7}
Loads all the registers R0 to R7 starting at the address given by R10 and going upwards through memory one word (4 bytes) at a time. The list of registers to be dealt with can be given in any order since they are automatically stored so that the lowest numbered register ends up at the lowest address in memory.

You can choose whether the addresses used Increase or Decrease relative to the base address by following the three letter mnemonic by either an I or D. In addition you can choose whether the addresses are altered in this way Before or After each register is loaded or stored by giving a B or A. See Diagram 4 for an illustration.

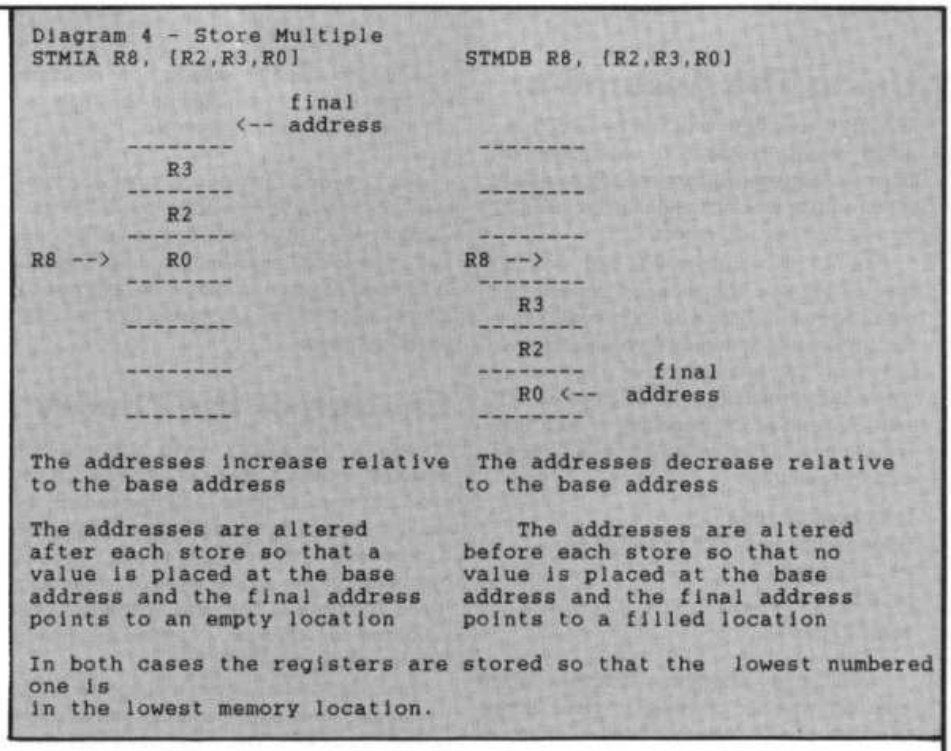


Diagram 4 - Store Multiple
STMIA R8, {R2,R3,R0}
STMDB R8, {R2,R3,R0}
final address
R3
R2
R8 -->
R0
R8 -->
R3
R2
R0
final address
The addresses increase relative to the base address
The addresses are altered after each store so that a value is placed at the base address and the final address points to an empty location
The addresses decrease relative to the base address
The addresses are altered before each store so that no value is placed at the base address and the final address points to a filled location
In both cases the registers are stored so that the lowest numbered one is in the lowest memory location.

When the instruction has finished R10 is unchanged. However this need not be the case. If you choose to you can force the base register to be updated at the end. This is called write-back and is specified using an exclaimation mark at the end of the instruction.
LDMIA R10,{R0-R7}!
This means that the address used will be increased after every transfer and R10 will then have 4*8=32 added to it at the end. This is very useful for stepping on through memeory.

The Stack

Any 6502 programmers who have studied the list of instructions in table 1 may well have noticed the lack of a particular group of instructions, namely those which push values onto the stack or pull them off again. So why are they missing? The ARM doesn't have special instructions because it doesn't need them. All of the ingredients for stack operations are provided in the general purpose Load and Store multiple instructions.

Stacks can go up or down through memory. This is catered for by the "I" and "D" options. If you decrease the addresses when storing numbers, then to get the numbers back you must increase them again when loading them and vice versa. So you can either use LDM with I and STM with D or the other way around.

Stacks can also be "full" or "empty". If you alter the address *after* each store the address will then refer to the next *empty* location. In which case you need to alter it *before* performing a load so that it refers to a location containing the last value stored. Alternatively, if you alter the address *before* each store and AFTER each load the address will then alway refer to a FULL location.

This can all become rather confusing so it is best to stick to one sort of stack all the time. We chose to use FULL DESCENDING stacks in the operating system and I suggest you use the same. (You'll have to in some cases anyway.)

This choice was made because, out of all the options, it has the advanatage that if a list of registers are to be stored which include the program counter then this value wants to be the last one taken off the stack since re-loading it into PC changes the execution address and effectively ends the routine you were dealing with. Since the program counter is held in R15, the highest numbered register, it will always be stored at the highest address for a given list of registers. Therefore, if you wish to remove registers individually, then with an ascending stack it will be the first to be "pulled". Whereas with a descending one it will be the last as required.

The assembler is quite helpful in that it allows you to specify *Full-Descending* (or whatever) rather than having to remember whether this means IA,DB,IB or DA for Load or Store.

For example, to save registers on to the stack use
STMFD R13!,{R0,R1,R2}

To make the base address register act as a proper stack pointer it needs to be updated at the end of each command. This can be achieved by following it by a "!" which causes the value in the register to be changed to the final address.

Another convetion used in Arthur is that R13 is used as a stack pointer. This is another good convention for you to follow.

Software Interrupts

SWI is a very powerful instruction which allows access to all the operating system routines. To use this instruction, the registers should be pre-initialised to contain the arguments required by the routine. The SWI mnemonic is then used followed simply by the number or name of the routine required. Full details of SWI will be left for another time, below is a simple example to illustrate its use.
MOV R0, #"A" SWI "OS–WriteC"

►►

Using The Assembler

The ARM assembler is driven by BASIC in a similar manner to the 6502 assembler. The assembly language instructions are contained within square brackets and may be indented by any number of spaces.

The BASIC variables P% and O% are used to initialise the program counter and offset assembly address (if required). When the code contains forward references, two passes of the assembler are required to enable these references to be resolved. P% must be reset at the beginning of each pass. This can be achieved by using a FOR ... NEXT loop, for example:

```
DIM code% 1000
FOR pass% = 0 TO 3  STEP 3
P% = code%
[ OPT pass% ..... ]
NEXT pass%
```

OPT is an assembler directive which controls whether a listing is given during assembly (Bit 0), whether assembler errors are to be ignored (Bit 1) and whether offset assembly is to be performed (Bit 2). The usual values when offset assembly is not required are 0 for the first pass and 3 for the second. This means that assembler errors are suppressed on the first pass which is necessary since otherwise the assembly would fail if it encountered a forward reference. They are then enabled on the second since by this stage any forward references should have been resolved so any errors are "real" ones which you have made in the code. In addition an assembly listing is given on the final pass showing the code being produced.

The BASIC assembler contains other directives; EQUB, EQUW, EQUD for defining one, two or four bytes of memory respectively, and EQUS for defining a variable number of bytes between 1 and 255 for a string expression. It also contains a new directive, ALIGN, which aligns P% and O% to the next word boundary. Since all instructions must lie on a word bound- ary, ALIGN should be used after EQUB, EQUW and EQUS directives to ensure the following instructions are correctly located.

BASIC also provides a macro, ADR, which loads a register with the address of a label. The address is given relative to the PC rather than as an absolute address. This allows position independent code to be produced very easily. For example:

ADR R0, string .string
is equivalent to
ADD R0, PC, string-P%-8 ..... .string

Where the -8 is required to allow for the fact that the program counter will appear to be two instructions ahead of the current one. This is due to a technique called "pipelining" which means that while on part of the chip is busy with executing the instruction, other parts of the chip are already busy fetching and decodeing the ones that follow. ADR handles backwards references in a similar manner by substituting the ADD with a SUB instruction.

One final thing to note is how registers are used. They can be refered to simply by using their number. For example
LDR 0, #1
loads register 0 with the value 1. However, for clarity it is better to define the variables R0 ... R14 with the values 0 ... 14 inside the BASIC text and use those instead. In addition register 15 should be referred to by the name PC to emphasise that it is the program counter.

Enough of the Theory

Enough of the theory, what about a real example? Listing 5 contains a routine which takes a string and prints it out backwards. Its not a very exciting example, admittedly, but it does demonstrate a lot of the features mentioned in this article. Type it in and type RUN to compile it. The machine code produced can then be executed by typing CALL code%.

First the routine saves the registers R0, R1, R2 and the program counter onto a stack pointed to by R13. This is to ensure that they can be restored to their original values when the program has finished. Then an ADR macro is used to set R0 to the address of the start of the text. The end of the text is marked by a character 13 i.e. a carriage return. Note the ALIGN after the EQUS and EQUB to ensure subsequent instructions are word aligned. The main part of the routine then calls the "subroutine" print–reversed to do the work. When this returns the registers are recovered and the program returns to BASIC by resetting the PC.

The subroutine print–reversed contains two loops, push–loop and pull–loop. When push–loop is entered R0 is the pointer to the start of the string. The LDRB instruction loads the first character from this string into R1 and increases R0 by 1 so that it points to the next character. This character is checked to see if it is the carriage return denoting the end of the string. Then, conditionally on it not being the carriage return, the character is stored on the stack, R2 is incremented so that it contains a count of the number of characters pushed and the process is repeated.

When all the characters have been pushed, the last character to be placed on the stack is loaded into R0 and printed to the screen. R2 is decremented by 1 using SUBS which sets the flags to indicate if the end of the loop has been reached (0 characters left) or not. If the subtraction has not set the zero flag, the process is repeated.
When all the characters have been printed, the branch-and-link operation is ended by moving R14 into the program counter and so returning to instruction after the BL.

Example 5

```
 10 REM Reverse a string
 20 REM by Paul Fellows 1988
 30 REM
 40 REM Set up names of registers
 50 R0  = 0
 60 R1  = 1
 70 R2  = 2
 80 R13 = 15
 90 R14 = 14
100 PC  = 15
110 REM reserve space for code and
120 REM perform 2 passes
130 DIM code% 1000
140 FOR pass% = 0 TO 3 STEP 3
150 P% = code%
160 [OPT pass%
170  STMFD R13!, {R0,R1,R2,R14}
180  ADR R0, string
190  BL print_reversed
200  LDMFD R13!, {R0,R1,R2,PC}
210 .string
220  EQUS "This is some text"
230  EQUB 13
240  ALIGN
250 .print_reversed
260  MOV R2, #0
270 .push_loop
290  LDRB R1, [R0], #1
300  CMP R1, #13
310  STMNEFD R13!, {R1}
320  ADDNE R2, R2, #1
330  BNE push_loop
340 .pull_loop
350  LDMFD R13!, {R0}
360  SWI "OS_WriteC"
370  SUBS R2,R2, #1
380  BNE pull_loop
390  MOV PC, R14
400 ]
410 NEXT
```

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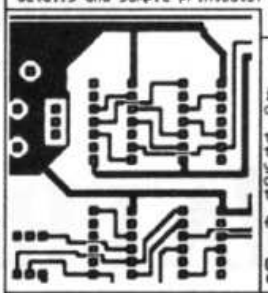

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DOT MATRIX MAGIC 3

In this review we cover two printer utilities. One is a disc-based desktop publishing aid, providing a range of fonts which can be used in a variety of sizes. The other is a sophisticated printer driver in ROM form.

The first is Beebug's disc utility *PRINTWISE*, which has been around for some time, but is now in improved form as version 1.3 (Series 2). It works on any of the BBC series computers, and requires an Epson-compatible or Shinwa CP80 (or similar) printer. In addition to the necessary program files, it contains nine fonts, each printable in one or more sizes. Specifically, there are two fonts in four sizes, five in two sizes and three in one size. The two fonts in the largest size are only available as capitals, and one of the fonts ("General") is the normal BBC Mode 7 character set. If you do not care for any of the fonts on offer, you can have as many sets of your own as you wish to design, every font being stored as a disc file. The basic font sizes are distinguished by the letters A to D, used as disc directories.

Print sizes are measured in the UK in "points", an archaic unit still resisting eventual metrication. A "point" is 1/72nd of an inch, so 72 pt print is an inch high, measured from the top of the highest ascender (normally the top of a capital letter) to the bottom of the lowest descender (eg the tail of a "g").

In addition to the four basic sizes, further variation is obtained by altering the printer graphics mode. Beebug distinguish five different modes, of which modes 0, 1 and 2 are available on all Epson compatibles. Mode 0 uses 240 dots/inch, mode 1 uses 120 dots/inch, and mode 2 overprints to give characters of mode 1 height and mode 0 width. It is possible to use either subscript or normal sizes in any of these modes, which, combined with the four font sizes, allows printing in fourteen different heights from 3.5 to 20 pt on all Epson FX, LX and RX printers. With a printer capable of producing double-height characters, this range can be extended to 40 point in mode 3. For Shinwa printers the equivalent range is 5.25 to 36 pt, using mode 4.

HYPERDRIVER PROPORTIONAL NLQ OUTPUT

This is Hyperdriver's NLQ typeface, a proportional spaced combination of Palatino and Times. Character design is by Wallace Nicoll. Printing is carried out in three passes of double density graphics for the highest possible quality, but always use a good quality ribbon for the best results. A special feature is that Hyperdriver allows embedded commands in a line of NLQ print, so you can use your printer's tabulation and margin facilities to produce reliable high quality proportional tabulated output, like this: -

```
First line      tab1    tab2   tab3tab4
Second line             column 2column 4
Third line     column 1         column 3
```

Here's the full character set, we hope you like it.

```
!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ
[\]^_£
abcdefghijklmnopqrstuvwxyz
{|}~
```

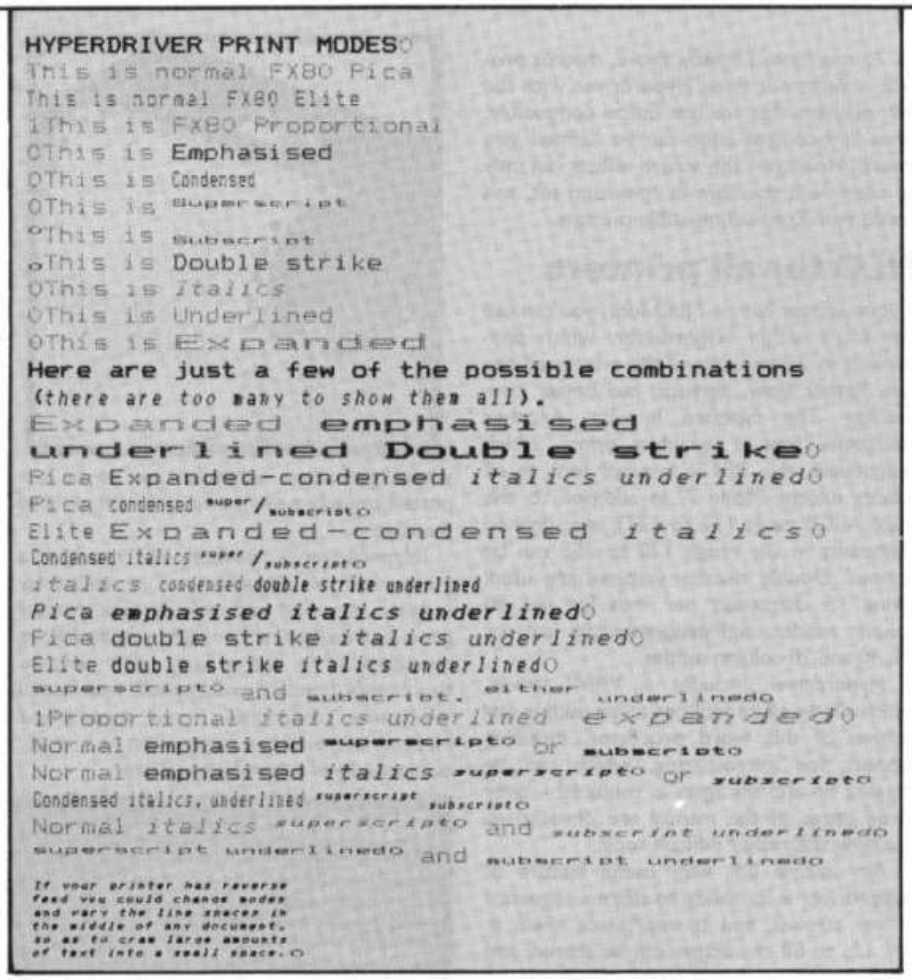
```
HYPERDRIVER CRT GRAPHICS OUTPUT.
This print mode uses the micro's screen display character definitions
to gives another interesting variation to your printer's capabilities.
It faithfully prints any character displayed, including any you have
defined, without any special programming. 80 character screen modes
give 15cpi, roughly halfway between elite and pica condensed sizes. 40
and 20 column modes are two and four times bigger respectively. To
exactly match screen proportions you can adjust line spacing. This is
nine lines per inch, but you can use whatever line spacing suits your
needs. Here's the full standard character set in CRT graphics.

!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ
[\]^_£
abcdefghijklmnopqrstuvwxyz
{|}~
```

A word to the wise?

Although it is possible to type the text to be printed directly into Printwise, no editing of any kind is provided, and this method is only practicable for headings, or very brief, uncomplicated text. The recommended procedure is to compose the text in a wordprocessor, which may be Wordwise or Wordwise Plus, Interword, View or Mini Office II. Other wordprocessors may be useable, but this must be a matter for experiment. Printwise was originally developed for use with Wordwise and Wordwise Plus, consequently these wordprocessors are particularly easy to use. In Interword, commands are entered as bold text, and Interword's own embedded commands and marked options must not be used. View is a bit more complicated, but not unduly so, and Mini Office II, like Wordwise, is very straightforward.

All Printwise functions are called by embedded commands, like those in Wordwise. Commands are provided to turn paging on or off, set margins, page length or indents, centre text, define tab positions, alter justification, control printer functions and so on. Printwise can hold two fonts in memory at the same time, and can switch between them as often as required. Alternative fonts can also be loaded at any point in the text, so there is plenty of flexibility for changing fonts, even within lines. It is also possible to alter both letter and word spacings either permanently or temporarily.

There are no complicated printer control


HYPERDRIVER PRINT MODES
This is normal FX80 Pica
This is normal FX80 Elite
This is FX80 Proportional
This is Emphasised
This is Condensed
This is Superscript
This is Subscript
This is Double strike
This is Italics
This is Underlined
This is Expanded
Here are just a few of the possible combinations
(there are too many to show them all).
Expanded emphasised
underlined Double strike
Pica Expanded-condensed italics underlined
Pica condensed super/subscripts
Elite Expanded-condensed italics
Condensed italics super/subscripts
italics condensed double strike underlined
Pica emphasised italics underlined
Pica double strike italics underlined
Elite double strike italics underlined
superscripts and subscript, either underlined
Proportional italics underlined expanded
Normal emphasised superscripts or subscripts
Normal emphasised italics superscripts or subscripts
Condensed italics, underlined superscript subscripts
Normal italics superscripts and subscript underlined
superscript underlined and subscript underlined
If your printer has reverse feed you could change modes and vary the line spaces in the middle of any document, so as to cram large amounts of text into a small space.

codes to remember – only simple, two-letter commands are used. There is a very versatile tabulator, which, in addition to the normal tab action, can print spaces between one tab stop and the next. It can also print any character at regular, specified intervals between tab stops. Other uses include underlining, and forcing a new line which starts at the first tab stop.

Your character is safe

An important feature of Printwise is its font generator, used to create and edit fonts in 12, 14 or 16 pt for an Epson printer, and up to 20 pt if descenders are not used. A new font can be created from scratch, but a current font can usually be adapted with less labour. The editor is very flexible and completely safe, in that only a specific decision to redefine an existing font will cause it to be overwritten. Similarly, it is not easy to lose characters once work on them has started.

The generator is entered through a front end menu with nine options, including load, save and quit. Other options allow the creation or editing of a font, (one character only or all in sequence), and scrolling through a graphical representation of the font at selectable grid increments. The remaining options allow the font variables to be altered, the font index to be displayed or the font pointer to be reset. The font variables determine the spacing between words, and between letters, in Roman and italic fonts. The font pointer points to the location in which the next letter is to be stored, and the font index contains the start address for each character definition and its length. The latter information can be used to save space by using all, or part, of one character as part of another. By resetting the font pointer it may often be possible to tuck a small character into a space not fully utilised by an existing one.

Most operations in editing fonts are carried out by using CTRL with one of 17 keys. There is little point in detailing them all here – suffice it to say that they are comprehensive, and offer a great deal of very practical help. The default text is proportionally spaced, but constant spacing can be used if required, the TYPEWRITER font provided being an example.

The ASCII codes 33 to 126 are used for Roman (upright) characters, and 161 to 254 for italics. In many cases some characters could be common to both fonts, for example arithmetic symbols. To save font space, which is always at a premium, any character with a code of 128 or greater can be "reflexed", that is, the font pointer for that code can be made to point to the existing character which is 128 lower. This is very easy to do, requiring only a simple key press.

The 56-page manual is very straightforward and clearly written (though it has a number of harmless typographical errors), and it contains plenty of helpful advice, including a chapter on space saving techniques. An appendix shows the full range of built-in fonts, and there is specialist help with Greek text. The lack of a proper index is of little account by reason of the logical organisation. This improved utility continues to fill a clearly identifiable niche at a very affordable price.

Show your printer who's boss!

HYPERDRIVER is a ROM printer driver with some very nice features. The package contains the ROM itself, plus a ROM image on 40 track disc, together with a number of files, including printer tests, instructional demonstrations, and sample text for printing, using any of the common wordprocessors. It is compatible with all BBC computers (including a 6502 second processor), and can be used with any wordprocessor that can handle OS commands. It can print from all versions of BASIC, or directly from the keyboard. It will even function, within strict limits, with Z80 or 512 processors. It controls any printer effect of which your printer is capable, and can emulate a number of these on the screen, giving a much better preview of the printed layout. The wordprocessors specifically mentioned in the manual, with appropriate hints, are InterWord, View, View Professional and Wordwise Plus. Note that Wordwise (without the "Plus") does not support OS commands. Hyperdriver printer codes are suitable for Epson compatibles, but other printers can be accommodated by using macros – see below.

Hyperdriver is first and last a remarkably friendly utility. It contains a number of HELP screens, which saves hunting for the manual every time you forget a command. There are so many of them that a low priority socket is recommended, to prevent abbreviated commands to other ROMs from being grabbed by Hyperdriver. When an ambiguous command is intended for Hyperdriver, it can be prefaced by the letter Y.

Commands, including parameters, are fully validated as far as is possible, and the addition of a space or full stop after a command will not cause an error. Errors, and certain actions that might lead to errors, are brought to the user's attention before the command is acted on, and confirmation (by pressing RETURN) is needed before Hyperdriver will proceed. No command is abandoned part way through execution, and every command string is fully processed, all valid parts being acted on until an error occurs. In particular, nothing is sent to the printer, or to or from a file, unless the appropriate command is completely valid. Errors are flagged with an up-arrow under the incorrect command, which is reproduced as part of the error message. Errors originated by other ROMs which have been called by Hyperdriver are dealt with in the same way.

For the majority of errors the application is not immediately aborted. Instead, you can see what has happened, and can elect either to continue, or to stop in a tidy fashion. All this saves a great deal of confusion and frustration. Of course Hyperdriver does not know which commands a particular printer can act upon, and expects the right ones to be issued. Error messages are explicit, and are clearly explained in the manual.

►►

WYSI pretty well WYG

The simulation of printer modes on the screen applies to expanded, italics, underline, bold, superscript, subscript and condensed print. Of these, condensed print is shown in reverse video because of limitations in the BBC display, and similarly bold characters are used for both double strike and emphasised print. For obvious reasons this facility is not available in Mode 7. These effects work during printing, but a lot of trials (and paper) can be saved by calling Hyperdriver's test print mode. This lets you see all the screen effects without actually printing anything. Although the correspondence between screen and eventual printout is not exact, it is sufficient to give a good idea of the final result, including formatting and page numbering. Screen effects do not work with InterWord, or any other wordprocessor which incorporates its own VDU driver.

An important feature of Hyperdriver is its use of macros. A macro can replace any string of commands by one short one. Up to 10 macros, each of up to 17 characters (excluding the header), can be defined as a set. Each set can then be saved to disc and recalled when required, thus allowing any number of macros to be used in a single document. Macros can tidy up what would otherwise be a real mess of embedded commands, and are much more economical of computer memory. Since Hyperdriver cannot know what a complete macro is supposed to do, error trapping is confined to checking the syntax and the range of the macro number.

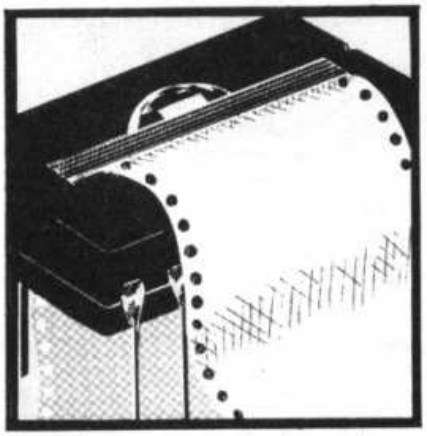
As mentioned briefly above, macros provide a means for using Hyperdriver with the few printers that are not Epson compatible, since any control code can be defined in a macro. However, the screen effects can only be used with the built-in command set, and hence with Epson compatible printers.

NLQ for all printers

If your printer has no NLQ font, you can use one from within Hyperdriver, which produces it in three passes of the print head per line. Rather slow, perhaps, but better than nothing. The typeface is pica. Another alternative font is "graphics print", which reproduces the BBC's internal font in all modes except Mode 7. In addition to the usual ASCII range (32 to 127), user-defined characters in the range 128 to 255 can be printed. Double density graphics are used, giving 15 characters per inch for the 80 column modes, and proportionally less for the 40 and 20 column modes.

Hyperdriver includes a VIEW driver, which allows all its facilities to be used in any version of this word processor, including support for microspacing, which can be toggled on and off again as required – over three pages of the manual are devoted to clarifying this rather difficult topic.

An unusual but very useful feature of Hyperdriver is its ability to store a sequence of key strokes, and to reproduce them at will. Up to 58 characters can be stored, and these can be used as a string, which can be inserted as often as needed in a piece of text or BASIC program, without having to type it out each time. Another use is in editing,



where the same operation has to be repeated a number of times in different parts of the text.

Hyperdriver is obviously the result of a great deal of thought, and is eminently sensible, practical and unfussy. The manual goes well beyond what might reasonably be expected of it, being very well written, thoroughly practical and packed with useful information and hints. I can recommend Hyperdriver without reservation as a really painless way of controlling a printer.

Factfile

PRINTWISE – on 40 or 80 track disc.
From: Beebug, Dolphin Place, Holywell Hill, St. Albans, Herts. AL1 1EX ☎ 0727 40303.
Price: £30.00 (members £22.50) including VAT.
HYPERDRIVER ROM and utilities disc. From: most dealers – in case of difficulty, direct from Dabs Press, 76 Gardner Road, Prestwich, Manchester M25 7HU. ☎ 061 773 2413.
Price: £29.95 inclusive.

So you think you can write?

Ever fancied yourself as a writer for **A&B Computing?** We are constantly on the lookout for freelance writers with an eye for good English, a technical mind, and a way with words.

All *you* have to do is send in a review, it doesn't have to be a favourable one – just make sure it is between 250 to 500 words long – printed with wide margins and double spaced lines. A BBC Micro or Archimedes word processor is a necessity – but please don't bother sending a disc.

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If you have a listing, that's great! Send in the program (on disc please) and we will have a look at it – good rates are paid for the most suitable programs, so get to work!

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MICROBRUSH

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Microbrush is a professional graphics package for either the BBC B or the Master. Whichever machine you have, Microbrush transforms it into a powerful graphics computer. If you own a Master then Microbrush offers you vastly extended resolution in modes 1 and 0.

Mode 0 - 1216 • 416
Mode 1 - 608 • 416

This complete A4 page was composed as one mode 0 high resolution image using the outboard scroll system, and has a resolution of 1216 • 900 pixels.

The BBC B version of Microbrush is comprised of two 16K roms. The Master version contains a third rom. The first two roms can be used in either of the computers.

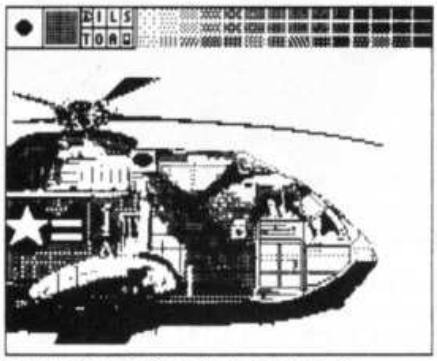
The whole system is menu driven and controlled by the Marconi RB2 tracker ball for speed and precision, but may also be used with either the AMX or the Whigmore mouse. Please note, the tracker ball is not included.

Microbrush A - £150 2, 16K roms + disc utilities, BBC B and Master
Microbrush B - £200 3, 16K roms + disc utilities, the Master only

When ordering please remember to state which system you require, whether you need 40 or 80 track discs and a telephone no. if you have one. Orders and information requests should be sent to-AB Designs, 81 Sutton Common Road, Sutton, Surrey. Phone 01 644 6643

The Colour System

This is just 1 of 33 major graphic systems contained within Microbrush and offers you 42 colours in mode 1 and 42 grey tones in mode 0. New colour palettes can be created with which you can draw lines, sketch, fill, paint in foreground, background, opaque, transparent and combined colour. Add this to a colour rubber which will selectively erase any actual colour and you have a very powerful painting system with more than **1,000,000** possible colours.



Above the painting system in mode 0.

The Ikon Generator

The ikon generator is the main workhorse of the Microbrush system as it is used for both generating and positioning any ikon up to 6•3 character blocks. This system is also used by the typesetter and for creating colour palettes, rubbers, paint-brushes and typefaces. Up to 46 ikons can be stored in memory. The scope of the ikon facility is immense as it allows you to transform the Microbrush system into a purpose built design tool that suits your needs.

The Type Setter

With the Microbrush system you will receive 50 proportionally spaced typefaces. The smallest allows you up to 170 characters to the line and if this is not enough then you can design your own typefaces.

The typesetter displays the current font as a scrollable menu allowing you to quickly produce professional typography.

The Screen Editor and the Special Effects Generator

The screen editor is a powerful drag system with which you can store up to a quarter of the screen in memory. Once stored, images can literally be dragged across the screen, repeated, copied, saved to disc or fed to the special effects generator.

The Special Effects Generator

This is a very versatile system which will automatically outline, inline, shadow, 3D, tint, half-tone, etc. any image held within the screen editor's memory.

The Injector rom

The Injector rom is the second rom in the Microbrush system. This rom contains the drawing functions such as lines, rectangles, circles, ellipses, arcs, rotate, zoom, squash, stretch, halve and quarter screens, plus a whole host of other functions.

This is a very brief description of just 7 of the 33 graphics systems contained within Microbrush. All of the systems are both fast and easy to access. Microbrush also includes a 7•7 character pixel editor and an Epson FX80 screen dump for mode 0 and mode 1.

The Master rom

The Master rom takes you into a completely different world of graphics with almost 4 times the resolution in modes 1 and 0 plus 2 on-board graphics screens, 10 rom based typefaces and a 10 point perspective system. This is linked to a 3D generator soon to be released on a 4th rom, for complex perspective tasks such as the camera seen above. Also available for the Master rom is an outboard scroll system which allows you to build images with a resolution greater than 1216 • 2000, plus there are high res. screen dumps for both Epson and Integrex printers.

Lastly flick through the pages of this magazine and see how many of the other graphic systems are capable of producing their own advertising to this standard.

Extensions to the Microbrush system include - The outboard scroll system - £40, an extended Master rom offering you 14 solid colours in mode 1 and 4 solid colours in mode 0 - £85, a typeface editor plus fifteen extra typefaces - £25, the Master rom when purchased separately - £65.

Darrin Williamson

Double or Nothing

Back in June of 1983 Watford Electronics produced one of the first Double Density Disk Interfaces for the BBC Micro. This has established itself as one of the most widely used DFS's of this format.

Since then there has been several advances in Beeb technology. Most notably the advent of Acorn's *1770 DFS*, the *ADFS* and the wider use of the Tube. With this in mind Watford have seen fit to add a few features to the DDFS in order to arm it for the future.

Why DDFS?

What a double density interface offers the user over a bog standard DFS is, not surprisingly greater disk capacity although not, in fact, double. Only about 80% at best. Mind you that's still better than a poke in the eye with an IC extractor tool! Furthermore it will allow you to have a single file take up the whole surface of a disk which is good news for anyone with a database that formats a datafile in this way (ie *Masterfile II*).

So who is in the market for such a device? Well just about anyone who has ever had a **Disc Full** message at an inopportune moment (in other words just about all of us, right?).

Why Watford?

The Mk2 board is a good third smaller than its predecessor which sounds like good news for people with ROM Boards that veer off to the left but unfortunately isn't. Ah well, you'll just have to get a ribbon extension to one or other of the sockets. The Watford Board has a number of nice features that set it apart from the competition.

Firstly It is *ADFS* compatible (good news for Hard Disk owners). It incorporates the Tube host code so you don't need a *DNFS* Rom in your machine. This allows the benefits of Double Density whilst using co-processors like the Master 512. Watford also promise better software compatibility although I have to admit that being a Watford Mk1 owner for several years I've not found any bits of software that don't work, but apparently there was so they felt they should improve matters. Fair enough!

The new 1.54T ROM has a few improvements as well. No need to use the *OPT40/80 command anymore, all that switching business is now automated. The *OPT2,1 command boosts the Disk handling and access speeds to *DNFS* levels. All these clever little functions have pushed the basic (as opposed to BASIC) Disk Editor out into the cold, which might prove a disappointment to some but most people seem to use an external sector editor anyway. And for those of you who like to use BPUT & BGET commands ie all those of you who mess about with BASIC (as opposed to basic) programs; you can do so at twice the normal speed.

Conclusions

If you need an upgrade DFS for your machine then I can certainly recommend the purchase of the Watford interface. They've obviously taken note of the changes in the market over the last few years and have adapted admirably.

Factfile

● Watford Electronics, Jessa House, 250 High Street, Watford, Herts WD1 2AN. ☎ (0923) 37774

THE WARE HOUSE

Ann Owen

Morley Masterboard AA

What we look for in a ROM board is reliability of design, compatibility and flexibility. This Morley design exclusively for the Master 128 is a sturdy piece of BBC on-board hardware.

Its installation requires no more than the slotting of pins into a couple of open sockets and the connection of two wires to links 18 and 19 – always forget which way round, east or west, these links should be? Me too.

Compatibility with various EPROM and ROM types is provided. There are eight 16K sockets which can be used with both 8K and 16K EPROMs and PALPROMs such as those used by Computer Concepts and Watford Electronics. The two 32K sockets provide for 32K EPROMs which, on the BBC, often means two 16K images blown side by side.

However, the board suffers from total incompatibility with Econet. Firstly because it takes up the space reserved for an Econet card and secondly because it uses Econet workspace for control software code.

Flexibility

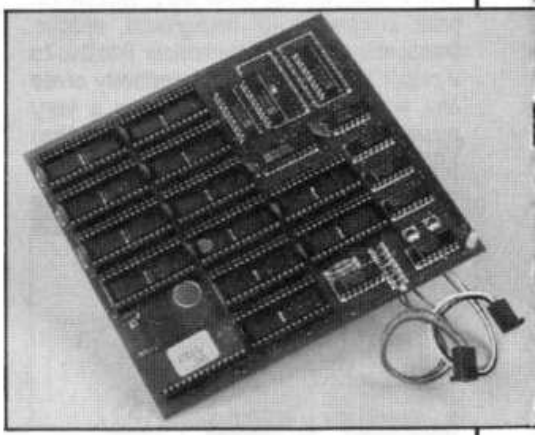
Flexibility is introduced via control software which is already on-board in an EPROM of its own. *HELP MORLEY reveals:

Masterboard 1.00 LO <bank No.> HI <bank No.>
LBOARD – List banks on ROM board FICOPY – File copy program

*FICOPY is a filler available in other guises, namely MasterCopy. If you don't already have a DFS/ADFS copier, this is one of the nicest.

*LBOARD reveals all, listing the ROM names installed in the AA board and the banks currently selected. The commands *LO and *HI configure the ROMs in the AA board and available sideways RAM as you currently wish to use them. *LO selects the ROM images or SWR banks that are to appear inserted in slots 4 and 5 on the Master (as revealed by *ROMs). *HI carries out the same operation in respect of ROM slots 6 and 7.

The control software recognises eight banks on the AA board, 0 to 7, each with two ROM incumbents. It is easy to quickly make active any pair of ROMs, say Interword and Spellmaster, or to switch in a couple of RAM banks for use as a Mode 7 framestore or to play an extended Master version of a Superior game.



Some ROMs need CTRL/BREAK initialisation when "software inserted" but in general the method is a clean way of installing your ROM collection in the required combinations.

Factfile

Price £46.00 plus £2.00 postage and packing. Available from: Morley Electronics, Unit 3 Maurice Road Industrial Estate, Wallsend, Tyne & Wear, NE28 6BY. ☎ 091 2627507.

Watford Electronics

Distributors of: Electronic Components, Micro Computers & Peripherals

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NEW

Panasonic KX-P4450 Laser Printer

The Laser printer has come of age!

For amazing speed, features and price, you would be forgiven for thinking that the Panasonic KX-P4450 laser printer would be expensive! But you would be wrong.

At eleven pages a minute, with two A4 size paper trays – this printer can offer a detailed 300 dpi (dots per inch) resolution with five popular printer emulation modes offering complete compatibility with your software packages.

The KX-P4450 printer offers as standard, both RS232 and Centronics parallel printer ports.

With 512K of RAM built into the printer itself there are no additional cards to worry about – although you can easily expand it to 1.5 megabytes!

A 15 character LCD display for system messages.

A hardworking 50000 page per month duty cycle.

An optional font card facility offering flexible printing styles.

The Cards include facsimilies of Times Roman, and Hewlett fonts, and the printer itself can emulate the Popular Hewlett Packard LaserJet Plus printer, the Epson FX-286, the IBM Proprinter, Panasonic's own KX-P 1083 and the diable 630.

Panasonic UK Ltd have awarded Watford Electronics premier dealer for Panasonic Printers 1987.

We are proud to present a very special laser printer, the Panasonic KX-P4450, which includes two paper trays to make paper handling a lot more easier then ever before, it is a surefire winner. Don't delay, ring or write in for a technical brochure now!!!

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310M Series

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(Securicor carr. £10 on Micros)

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(P.S. This offer does not apply with 0% finance scheme mentioned in column two).

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I/O Podule (with User port, Analogue port & 1MHz bus)	£79
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Intersheet ROM	£35	Viewsheet	£49

BUSINESS GRAPHICS

GammaPlot	£30	Interchart ROM	£22

INTEGRATED PACKAGES

Logistix – Database, Spreadsheet, Time Management & Business Graphics £95

PC EMULATION Pack

(for 310, 410 & 440), including MSDOS 3.21 £79

GRAPHICS, ART & DESIGN

Interchart	£25	Gamma Plot	£30
Artisan	£31	Gamma Plus	£60
Zarch	£16	Toolkit (Beebug)	£32
		Toolkit (Clares)	£31

LANGUAGES

ANSI 'C'; ISO-PASCAL; FORTRAN 77;	£95 each
Cambridge LISP; PROLOG X	£181 each
TWIN EDITOR	£27
Archimedes Assembler	£199

0% (APR) FINANCE

*For a limited period, Watford Electronics are able to offer the Archimedes range of microcomputers at **0% (APR)** finance. Credit facility available subject to status. Please inquire for further details.*
(Watford Electronics are Licenced Credit Brokers)

CREDIT TERMS now available. Please telephone or write in for further information.

Archimedes to BBC SERIAL LINK

Using this simple data link, it is possible to solve all your BBC to Archimedes data transfer problems. The kit is supplied with a disk, and the necessary cable to connect the two computers. Using this package it is possible to transfer any data from the BBC to Archimedes at upto 19200 baud.
By far the easiest way to transfer data to your new computer.

Only £25

Archimedes 5¼"/3½" Disc drive Interface

With this interface it is possible to connect almost any 5¼"/3½" disc drive with its own power supply to the Archimedes. NO SOLDERING is involved. Supplied complete with necessary lead.

Only £19

Note: This is not simply a lead. Attempting to connect an external disc drive by direct connection may result in damage to your Micro.

Watford Electronics are the main Approved Stockist of ACORN SPARES and ECONET Referral Centre

The 80186 Co-Processor

This package consists of the Master 512 board, Watford Co-Pro Adaptor, 1770 Disc Upgrade and Acorn ADFS. This is a complete package, with its own power supply, ready to interface with your BBC Micro. The Master 512 board using the 80186 16 bit Processor at 10MHz and running Digital Research DOS Plus, gives a high degree of IBM compatibility at an extremely reasonable price. Included in the 512k package is a mouse and the amazing Digital Research GEM suite of software; GEM Paint, GEM draw and GEM desktop giving a complete Mouse Icons environment (All other GEM packages will work on the 512k). Famous packages that will work with the 512k board include Wordstar, Dbase II, Lotus 123 and many others. The only requirement to upgrade any BBC Model B to this system is you must have twin 80 track disc drives.

£259

BBC MASTER

BBC MASTER 128K Micro incl. Acorn's: View, Viewsheet, ADFS, BASIC Editor & TERMINAL plus £125 worth of FREE OFFER (see below)

£379

SPECIAL OFFER

FREE . . . £105 worth of Hardware & Software

*Gemini's OFFICE MATE & OFFICE MASTER packages on Disc consisting of: Database, Spreadsheet, Beebplot graphics. Accounts packs: Cashbook, Final Accounts, Mailist, Easyledger, Invoice & Statements, Stock Control and **Watford's** 3½", double sided 1 Megabyte (unformated) single disc drive complete with cables, ready to connect to the micro – with every BBC Master purchased from us this month.*

BBC MASTER with Turbo Board + above SPECIAL OFFER ***£475***

512K Processor Add on Board "inc. Mouse and GEM package" ***£185***

BBC AIV (Domesday) System ***£3999***

ADD-ONs & ACCESSORIES

Turbo 65C102 Add-on Module		£95
Econet Module for the Master		£40
Twin ROM Cartridge for Master		£7.50
Quad ROM Cartridge for Master		£11
Universal Processor Adaptor		£75
Master Reference Manual I	(No VAT)	£14
Master Reference Manual II	(No VAT)	£14
Master Advance Ref. Manual	(No VAT)	£19
64K Upgrade Kit for B+		£32
Acorn 1770 DFS Kit complete		£41
ECONET Upgrade Kit for BBC		£42
ALL ECONET UPGRADES Available		
ARIES' Professional IEEE Interface		£238
Acorn IEEE Interface Complete		£265
Morley Teletext Adaptor with ATS Rom		£99
Filestore E01		£825
Filestore E20		£699

BBC MASTER COMPACT

System 1	Standard Package	£310
System 1A	System 1 + TV Modulator	£322
System 2	System 1 + Green Hires Monitor	£364
System 3	System 1 + Medium Res Colour Monitor	£478
RS232 Kit for BBC Compact		£25
Additional 3½" Drive for BBC Compact (Securicor carriage £7)		£90

65C102 2nd PROCESSOR

(65C102 replaces the original Acorn 6502 2nd Processor)

This amazing package consists of the Acorn 65C102 'Turbo' Board, the Watford Co-Pro Adaptor and Acorn 1.2 DNFS ROM. The 'Turbo' board, running at 4MHz with 64k of additional RAM will increase the speed by between 50 and 200% depending on the application running, and allow a BASIC program of upto 44k in any screen mode. Simply by plugging in the Co-Pro and the DNFS ROM with its special Tube host code and you massively increase the power of any Model B. This is a complete package, with its own power supply, ready to interface with your BBC Micro.

£135

Z88 Sinclair's Portable Micro

The worlds first, truly portable Micro. It is A4 size, only an inch thick and weighs under 2lbs. Ideal for use when travelling or as a personal organiser.

Only: £239

FREE

With every Z88 purchased from us this month, we are giving away absolutely FREE, a Z88 to BBC Interface Link, 4 rechargeable batteries and a compact Mains Battery Charger worth £38.'

ACCESSORIES

Mains Adaptor	£8.65
32K RAM Pack or 32K EPROM Pack	£17.35
128K RAM Pack or 128K EPROM Pack	£43.40
512K RAM Pack	£169
Z88 to BBC Link	£21.70
Z88 to PC Link II	£30
Z88 EPROM ERASER	£34.75
Serial Printer Cable	£8.65
Parallel Printer Cable	£24.00
Z88 Modem	£86.90
Z88 Soft Carrying Case	£8.50
Sinclair Z88 Computing Book	£9.95
AA Nicad Rechargeable Battery	£1.50
Battery Charger, Compact & Fast (3 Hours)	£6

CO-PRO Adaptor

Now for the first time you can add the Master Co-processor boards, to your standard BBC model B, or B Plus. With this brand new launch from Watford Electronics you can attach any BBC Master co-processor to the original BBC Micro. Once again Watford strides ahead with a new concept in BBC B Micro add-ons. This unique external Co-Pro Adaptor, is protected by patent applications.

Use the super fast Turbo Board with your BBC B, it is much faster than the 6502 2nd processor superseding it.

With the 512K addon your standard BBC machine achieves IBM PC compatibility at a realistic price running GEM, Lotus 123 and many other programs. Included with the 512k package is a high precision mouse and the Digital Research GEM suite of software; GEM Desktop, GEM Write GEM Paint. This requires both the 1770 DFS and the ADFS to be fitted to your computer.

To use other co-processors you require a BBC B with DNFS 1.20 or higher, or BBC B+ fitted with 1770 DFS 2.20 or greater. Co-processors work exactly like a second processor.

Master owners may use Co-Pro to add a second Co-processor externally.

Watford, brings power to your BBC at only:

£35 (carr £5)

Watford Electronics are Appointed & Authorised DEALERS / REPAIR CENTRE for Acorn Computers Ltd Microvitec Monitors Panasonic Printers

NEW

BBC PCB DESIGNER

At last! A PCB design package for the BBC Micro that eclipses some industry CAD software. Hard to believe, isn't it? Just look at some of the impressive package specification:

- Library Component Designer
- Component Library (over 200 parts)
- Component List Editor
- NetList Editor
- PCB Board Designer
- Plotter Driver
- Dot Matrix Printer Driver

This integrated suite of programs is packed full of sophisticated PCB related features making the design of a circuit board a dream instead of a nightmare.

Input for the design may be manual, taking components from the library and connecting them, or highly automatic starting from a netlist and list of components. In auto mode, PCB Designer will never allow you to forget a connection again! And of course, either in manual or auto mode, connectivity is maintained no matter how you later move the parts around and route the tracks. Connections snap together and angles are corrected. Through hole vias and track thickness are established automatically and many more features, far too numerous to mention here, are included in the system.

Some of the PCB Designer's features are:

- Over 120 library pad sizes/shapes
- Four colour adjustable palette
- Zoom range 2:1 to 1:4
- Highlighting of specific tracks
- Normal and surface mounted components
- Rapid screen review
- Menu driven
- Variable gridlock
- Switchable measurement grid
- Pre-select pan/scroll facility
- Large 24" x 24" Board size
- Copy route facility
- Connectivity held at all times
- Ratsnesting of part connections
- Auto-plaement of text references
- Text linked to parts
- Automatic placement of vias
- Printer and plotter outputs provided
- Comprehensive manual

TYPES OF PLOT OUTPUT

Top and bottom track artworks, top and bottom silkscreens, solder resist mask, drilling detail drawing and check plot. All these may be with pad holes on/off, scale of 2:1 or 1:1, board edge on/off, 90 degres rotation, mirror image, width of pen, x & y offsets and batch plots to disc.

The above is only a taste of the superb features of this software, surely capturing previously unknown performance from the BBC Master computer. BBC B owners will need to fit at least one block of sideways RAM, Shadow screen memory and a disc drive. A trackerball or a mouse is also required.

BBC PCB Designer is supplied on a 32K PAL PROM and comes complete with two discs and a comprehensive manual containing examples and useful information on PCB design.

By the way, as a bonus, PCB Designer is also suitable for many other schematic drawing applications such as circuit diagram drawing.

Introductory Offer: £99

(Please write in for further technical details)

Archimedes Real-Time Digitiser

Watfords' Archimedes Video Digitiser is the most sophisticated digitiser ever designed for a micro. It provides a fast and flexible means of capturing images from a video camera or recorder for display and manipulation on the Archimedes range of Micros. Off-air television signals may also be digitised via a video recorder or TV tuner.

Once captured, Video images can be stretched, squahsed, rotated, stored on disk, printed, or used by applications software.

Applications include desktop publishing, graphics, animation, image analysis and recognition, medical imaging, automatic inspection and measurement, databases, interactive video, remote transmission of pictures via a modem, movement detection ... or anything else you can think of!

SPECIFICATION

SOFTWARE

All the driver software for the digitiser is contained in a ROM on the podule. Facilities provided include:

- Grabbing of images to the screen or dumping to memory.
- Continuous grabbing and display for previewing or camera alignment.
- 'Hot key' grabbing – pressing a (configurable) key combination grabs and displays an image on the screen while another program (e.g. paint software such as Artisan) is running.
- Scaling (zoom/shrink) any section of an image to any size in X and Y directions, with optional X/Y flip, window clip and logical (AND/OR/XOR) plotting.
- Rotation and scaling to any angle and size, rotating about any point, with optional window clip, and logical (AND/OR/XOR) plotting.
- Very versatile matrix printer screendump facility for Epson FX, LQ and EX compatible printers – pictures can be printed to ANY size (including multiple sheets) at any orientation, using any available printer density and one of six internal sets of dot patterns, or with user definable patterns (pattern editor supplied). The screen-dump can also be used for general purpose graphics screen printing.
- Pixel value lookup tables: pixel values can be passed through a user defined lookup table to allow contrast enhancement, thresholding pseudo-colouring etc.
- Smoothing and noise spot removal to enhance image quality.
- Creation of sprites from all or part of a digitised image.
- Saving and loading of digitised images in compressed format.
- Combination of pictures by adding, avaraging, subtracting, multiplication etc.
- Much faster versions of the Arthur *ScreenLoad and *ScreenSave commands.

Software facilities are accessed via operating system star (*) commands and SWI calls. High resolution screen modes using MultiSync type monitors are supported.

UTILITY DISK

A disk is included, containing sample pictures, examples and utility programs including the following:

- Colour image grabbing using colour filters with monochrome or colour cameras, including colour balance adjustment and scaling facilities.
- Pattern editor for 2 colour display modes and printer screendumps.
- 512 line interlaced display for non MultiSync monitors.
- Thresholding to create two colour images.
- Capture and replay of animated sequences.
- Several example programs illustrating the use of digitiser software.

RESOLUTION

Images are digitised to 512 (h) x 256 (v) pixels, and then scaled to fit the Archimedes' screen. It is possible to digitise to 512 x 512 pixels if the picture is stationary for about 0.1 second. 512 x 512 images can either be displayed on a MultiSync monitor, or on a normal monitor using interlacing.

Pictures are digitised to 64 levels of grey (6 bits). Note, however, that it is only possible to display all 64 levels on a monochrome monitor, or a colour monitor which has a composite (CVBS) input. For this reason, the Philips CM8533 monitor is recommended instead of the standard Archimedes monitor. It is also possible to connect both a colour and a monochrome monitor at the same time.

Any 2,16 or 256 colour graphics mode can be used to display digitised pictures. In two colour modes, grey levels are represented using dot patterns, which may be redefined if required (a pattern editor is supplied).

SPEED

Video fields are captured in real time (1/50th sec.), and then transferred to Archimedes' memory or the screen. The grab/display rate is dependant on the screen mode and picture size, up to 25 fields per second for quarter screen images, or 12.5 per second for fullscreen (Mode 9).

HARDWARE

The digitiser is a single width podule, with a BNC socket on the rear panel for the video input, which may optionally be terminated via a link. There is 128K of on-board memory to store the digitised image, and a 32K ROM on the podule contains all the driver software.

Automatic video level control and black level clamping circuitry is used to ensure that the optimum contrast is obtained from a variety of video sources. A filter is included to avoid patterning effects when using colour sources.

Price £249

Continued

All Monitors are supplied complete with BBC connecting leads FREE.

MICROV' 'EC 14"

- 1431 – Standard resolution as used on the BBC television computer programme **£175**
- 1451 – Medium resolution, suitable for word processing in mode 0 **£225**
- 1441 – High res, exceeds the capabilities of the BBC micro **£359**
- 1431AP RGB + PAL and AUDIO **£199**
- 1451AP RGB + PAL and AUDIO **£255**
- **2030 CS 20" Med Res** **£380**
- **2040 CS 20" Hi Res** **£675**
- Dust Cover for Microvitecs **£5.50**
- Touchtec 501 Touch Screen **£239**

TAXAN 12" & 14"

- **TAXAN Super Vision 2 Type 620** Hi-res RGB Colour monitor. Ideal for Wordprocessing **£263**
- **TAXAN Super 3, Type 625** Ultra Hi-res, RGB Colour) Text mode switch allows monochrome text display in Green, Amber, White reverse or White on Blue **£313**
- **TAXAN 14" Multisync 770 Plus** – An autoscanning Ultra high res, colour monitor. Ideal for Archimedes, IBM & Compatibles **£495**

- **NEC JC-1401P3EE 14"** Multisync Ultra Hi-res Intelligent Colour monitor. Auto scans frequencies between 15KHz to 35KHz. Text switch provides 7 colours for Database & wordprocessor. **£489**

PHILLIPS Monochrome 12"
BM7502 Hi-res Green **£69**

STAR BUY

- **PHILLIPS 14** Hi-Res, dark glass, attractively finished Colour Monitor - supplied complete with RGB, SKART and Audio/Phono Inputs. A push-button switch toggles between Hi-Res monochrome green text mode and full colour display.

ONLY £195

N.B. carriage on Monitors **£7** (securicor)

SPARE LEADS

BNC Lead for Zenith or Philips	**£3**
Skart Monitor Lead	**£5**
RGB lead for TAXAN Monitors	**£3**

SWIVEL BASES

for Video Monitors

By placing your monitor on one of our professional swivel bases (see monitors drawing above), you gain the freedom to adjust the monitor viewing angle to suit your needs and thus alleviate eye strain and reduce back stress. The front mounted adjustable control dial makes adjusting the monitor viewing angle very simple.

for 12" Monitors **£7** (carr. £2.50)
for 14" Monitors **£10** (carr. £2.50)

Anti-Glare VDU Screen

These extremely effective, easy to install, 12" & 14" VDU screens eliminate harmful glare, improves contrast on colour monitors. Increases productivity in offices. A must for all wordprocessor users. Hundreds of these screens are in daily use in various branches of one of the leading High Street banks.

£12

TAXAN KP-815 PRINTER

80 column, Bi-directional, 160 CPS, (NLQ 24cps); Friction & tractor feed + paper roll holder as standard; Epson FX compatible.

Offer Price £159

KAGA/TAXAN PRINTERS

Taxan KP915 132 Column Printerr (carr £7)	**£275**
RS232 Interface	**£49**
RS232 Interface with 2K Buffer	**£69**
RS232 Interface with 16K Buffer	**£89**

Panasonic KX-P1081

Attractively finished in BBC beige. Bi-directional, logic seeking. Has IBM and Epson RX compatible command calls. Speed: 120CPS draft mode, 24 CPS NLQ mode. Character width range from 5 cpi to 17 cpi. Upto 40 downloadable characters. Functions include, Proportional spacing, Justification, centering and left & right ranging.

(Price inludes, FREE a 4ft Printer Lead, and a Dump Out 3, Screen Dump ROM worth £35 with every printer purchased from us).

Special Price: **£145** (carr. £6)
Optional RS232 Interface: **£39**

Panasonic KX-P3131 Daisy-Wheel Printer

This low-cost high-performance Daisy Wheel printer is ideal for anyone wishing to produce clear, immaculate letters or reports. It delivers, flawless text at 10, 12 & 15 CPS. Supports proportional spacing. Is Bi-directional, logic seeking. Printing speed: 17CPS. Has 6k printer Buffer. A printer of similar spec could cost a lot more than our ridiculously low price of:

Only **£255** (carr. £7)

Single Sheet Feeder	**£175**
Tractor Feed	**£90**
Daisy Wheel (various)	**£12**
Ribbons: Standard **£4.50**; Long Life **£7**	
Extra 32K Printer Buffer (internally fitted)	**£10**

Panasonic KX-P4450 LASER PRINTER

Now available from stock. Please write in for technical details

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NEC P2200 PINWRITER

24 pin; 80 column; 168CPS – 56CPS LQ; Epson LQ compatible, 7K Buffer; 7 resident FONTS, Friction & Tractor feed, front load single sheet feed, etc.

Price: £275

Cut Sheet Feeder	**£65**
Additional Font Cartridge	**£25**
NEC P2200 Pinwriter Ribbon	**£6**

VARIOUS PRINTERS & ACCESSORIES

Brother HR20 Daisy Wheel	**£349**
HR20 Tractor Feed Attachment	**£110**
Epson EX800 Printer	**£346**
Epson EX1000 Printer	**£589**
Epson FX800 Printer	**£295**
Epson FX1000 Printer	**£425**
Epson GQ3500 Laser Printer	**£1290**
Star LC10 Printer	**£175**
Star LC10C Colour	**£215**
Epson LQ500 Printer	**£285**
Epson LQ800 Printer	**£399**
Epson LQ850 Printer	**£469**
Epson LQ1050 Printer	**£599**
Epson LQ2500+ Printer	**£749**
Epson LX800 Printer	**£189**
Epson SQ2500 Printer	**£975**
Epson Paper Roll Holder	**£17**
EX800/1000 Colour Option	**£55**
EX800/1000 Colour Ribbon	**£18**
HI80 Re-Fills – Set of 4 pens	**£7**
Hitachi 672 Colour Printer	**475**

CUT SHEET FEEDERS for
EX800 **£130**; EX1000 **£195**; FX800 **£135**; FX1000 **£169**; LQ/LX800 **£125**; LQ850 **£135**; LQ1050 **£75**; LX1000 **£305**.

TRACTOR FEED for
EX800/1000 **£78**; LQ800 **£44**; LQ850 **£69**; LQ1000 **£50**; LQ1050 **£75**; LQ2500 **£195**

(Securicor Carriage on Printers £7

EPSON PRINTER INTERFACES

All these interfaces fit inside the printer.

RS232	**£27**	RS232 + 2K Buffer	**£52**
IEEE 488	**£65**	RS232 + 8K Buffer	**£62**

INTEGREX COLOUR JET PRINTER

Colour Jet 132 Printer	**£515**
Paper Roll	**£6**
Screen Dump Software	**£10**
Colour Cartridge	**£14**
Black Cartridge	**£8**
100 A4 OHP transparencies	**£55**

Printer Sharers/Changers

Connect upto 5 Micros to 1 printer or 5 printers to 1 Micro with our Printer Sharers/Changers.
(Ideal for School environments.)

Connects	Serial	Centronics
2 to 1	£24	£25
3 to 1	£34	£35
5 to 1	£44	£45

(Cables extra at £6 each. Please specify type required when ordering)

Professional Printer Stand

This new professional printer stand takes hardly more space than your printer. Due to the positioning of the paper feed and re-fold compartments ie. one above the other, the desk space required for your printer functions is effectively halved. Additional facilities include: Easy access to paper from both sides, used with both top and bottom feed paper and with its dial controlled paper feed system with adjustable deflector plates it ensures smooth paper flow and automatic refolding.

80 Column version £23 (carr. £2.50)
132 Column version £26 (carr. £2.50)

THE EPSON RX-FX-KAGA PRINTER COMMANDS REVEALED

So you bought yourself a new printer, because the salesman in the shop showed you how clever it is and impressed you with all sorts of printouts to show its capabilities – he may even have offered you a special price.

However, now that you have got it home and connected it to your BBC microcomputer, you are wondering how to make it perform these magical tasks. The manual seems to give no clues, and when you type in the example programs, the computer throws the LPRINT statements back in your face.

Now what do you do, when this £400 piece of high technology refuses even to move its head, and you have stayed up until 2 in the morning with copious supplies of coffee, desperately trying to print something out. Once again, Watford Electronics comes to your help with our new book entitled 'THE EPSON FX-KAGA PRINTER COMMANDS REVEALED'.

This book describes in plain, easy to understand English, how to use and make the most of your KP810, PW1080A or any other Epson FX80 compatible Printers like Panasonic KX-P1080/1, etc., with the BBC Micro, both from BASIC and Wordwise.

It describes in detail how to obtain the maximum in graphics capability from your printer and includes full indexes allowing you to cross index the numerous commands. Every command is explained in detail, with an accompanying BBC Basic program and an example of its use from Wordwise.

£5.95 (No VAT)

PRINTER LEADS

Centronics lead for the BBC

Standard length (4 feet long)	£6
Extra long (6 feet long)	£8
Compact's Special Centronics Lead	£9
RS232 Cable	P.O.A.
IBM/Archimedes Parallel 1 metre lead	£7
Double ended 36 way Centronics Lead	£9

PRINTER RIBBONS & VARIOUS DUST COVERS

Type	Ribbons	Dust Covers
BBC Micro	–	£3.50
BBC Master	–	£4.00
Archimedes Micro pair	–	£9.00
Brother HR15/20	£3.00	£5.00
EX/LQ800	£7.50	£4.50
EX/LQ1000	£8.00	£5.00
RX/FX80/85/800/MX80	£4.00	£4.95
RX/FX100/1000	£6.00	–
Kaga/Texan KP810/815	£5.25	£4.00
LQ2500	£9.00	£5.50
LX80/86	£4.00	£4.50
LX800	£4.00	£4.75
M1009/GLP	£4.00	£3.75
Panasonic KX1080/81	£4.50	£4.75
SQ2500	£25.00	£5.50
Star NL10	£4.00	£4.50
Microvitec Metal	–	£5.50

Our attractive Dust Covers are manufactured from translucent PVC. The seams are stitched and edges are taped to prevent splitting due to continuous use.

Listing Paper (Perforated)

- 1,000 Sheets 9½" × 11" Fanfold Paper £7
- 2,000 Sheets 9½" × 11" Fanfold Paper £12
- 1000 Sheets 9½" x 11" NCR 2 Part Fanfold £19
- 1,000 Sheets 15" × 11" Fanfold Paper £9
- 1000 Sheets true A4 Fanfold Paper £11
- 2000 Sheets true A4 Fanfold Paper £20
- Teleprinter Roll (Econo paper) £4

(All our Fanfold paper is Micro perforated leaving a smooth clean edge when the tractor feed strips are detached).

Carriage 1K Sheets £2.50. 2K Sheets £3.00

PRINTER LABELS

(On continuous fanfold backing sheet)

1,000 90 × 36mm (Single Row)	£5.00
1,000 90 × 36mm (Twin Row)	£4.90
1,000 90 × 49mm (Twin Row)	£7.50
1,000 102 × 36mm (Twin Row)	£6.25

Carriage on 1,000 Labels £1.00

MEGABUFFER 256

This new Megabuffer 256 from Watford is a full featured 256K Printer Buffer. It allows the computer to print 256,000 character in a short time thus freeing the computer very quickly. In short it makes light work of printing large documents, screen dumps, etc. It is extremely simple to connect. The features are:

- Low Cost, High performance.
- Improves efficiency by making more efficient use of computer and printer.
- Compatible with any computer and printer that uses Centronics Parallel connections including all BBCs, IBM PCs, etc.
- Total compatibility with all software.
- Cheaper phone bills when using your Modems.
- Ideal for those doing large graphics screen dumps that are slow to print.
- Multi-Copy facility allows you to print several copies via Megabuffer without going through your computer.
- Data Dump facility is included.
- Built in test unit for both the buffer & your printer.

In conclusion it can safely be said that MEGABUFFER 256 is the ultimate printer Buffer for both the amateur and professional user.

Only £149 (carr £2)

OFFICE MASTER

CASHBOOK – A complete "Stand Alone" accounting software package for the cash based sole trader/partnership business. It is designed to replace your existing cashbook system and will provide you with a computerised system complete to trail balance.

FINAL ACCOUNTS – Will take data prepared by the Cashbook module and produce a complete set of accounts as following: Trial Balance with inbuilt rounding routine; Notes to the accounts; VAT Summary; Profit & Loss A/C; Balance Sheet.

MAILIST – A very versatile program. Enables you to keep records of names and addresses and then print, examine, sort and find them, all with special selection techniques.

EASILEDGER – A management aid software tool designed to run alongside an existing accounting system. Essentially a Debit/Credit ledger system which can handle sales, purchase and nominal ledger routines to provide instant management information.

INVOICES & STATEMENTS – Greatly reduces the time and cost of preparing Invoices and Statements by storing essential information like customer names, addresses and account numbers. Has VAT routines and footer messages facility.

STOCK CONTROL – Allows you to enter stock received, stock out, summary of stock items and current holdings together with details of total cost, total stock to minimum level, units in stock ordering, quantity and supplier detail.

All this for only **£21** (Disc)

OFFICE MATE

- DATABASE
- BEEBCALC SPREADSHEET
- BEEBPLOT GRAPHICS

DATABASE – Set up a computerised card index system with powerful search facilities.

SPREADSHEET – Offers many calculation and editing features.

BEEBPLOT – Provides visual representation from Spreadsheet data.

OFFICE MATE Only £10 (Disc)

New Launch Offers
Disc Drives DP35-800S

A Double disc drive – with a difference! Times are changing fast for the floppy disk, and whilst the current standard for the BBC B and Master Series is the 5.25 inch disk, the standard for the future will most certainly be the smaller; faster and more reliable 3.5 inch disks – now a standard feature of both the Master Compact and the Archimedes Series.

To support the present disc drive users, and cope with the future, we have designed our own plinth-mounted disk system – called the DP35 800S, it contains both the 5.25 inch and the 3.5 inch drive formats as well as offer a firm and rigid support for a monitor on top. With the BBC Micro underneath, the plinth makes a surprisingly small footprint on the desk – leaving you more space to work with.

The 5.25" disc drive is 40/80 track switchable. For ease of access, the switches are front mounted. DP35-800S has its own power supply, independent of the BBC Micro.

Watford's new plinth enables users to read, write and format disks both in DFS and ADFS format – currently the accepted standard for the Master Compact and the Archimedes, it also enables the user to read disks written for the Archimedes. Ideal for both BBC & Master.

Launch Offer: **£165** (carr. £7)

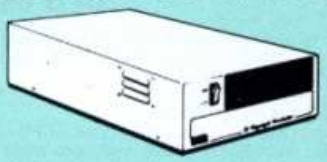
OKIMATE COLOUR PRINTER

The first ribbon transfer printer in its price range which offers fully versatile colour or black printing. A 24 element print head produces more than 100 shades with exceptional clarity. Ideal for use with Quest Paint or AMX Super Art.

Only: **£119**

BBC Screen Dump	£10
Colour Ribbon	£6
Black Ribbon	£6

30 Megabyte Winchester Drive



Undoubtedly the best value for money Winchester Hard disc available anywhere for the BBC Micro.

This 30 Megabyte hard disc is completely compatible with the Acorn ADFS – that's why we have bundled it with each Winchester drive, along with a full user guide and full utilities including file copy, 1000K save routines, Format and Verify – in fact all you need and more.

Finished in rugged metal and fetching BBC beige, the Winchester has an internal fan, so quiet you won't even hear it! A switched mode power supply and a neon-lit on/off switch are there along with a light on the hard disc to tell you when it is working – just compare the price with our competitors' 20 or 28 Mbyte discs!

Compatible with the Master, and the BBC B (with 17"X disc interface).

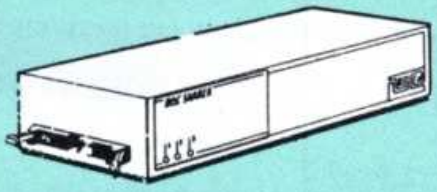
Launch Offer **£425** (Carr. £12)

CREDIT CARD 24 HOUR
Ansaphone Hot Lines
(0923) 50234 or 33383

Continued

NEW

DISC DRIVE SHARER



(Ideal for educational establishments)

At last, a low cost alternative to the Econet system. Watford's Intelligent Disc Drive Sharer allows you to connect 3 BBC micros (model B, B+ and Master series) to a single or double disc drive. Running under any DFS or DDFS, this intelligent unit will automatically queue the computers. Each computer has a status light dedicated to it. If it is green you will get immediate access to the disk, and red means that you are next in line. The unit plugs directly into the disc drive socket on each computer and is powered by the mains. (N.B. Not for use with ADFS.)

Launch Price: **£65** Price includes 3 Cables

NOW WITH EXTRA FEATURES AT NO EXTRA COST – Watford's latest DFS 1.44

- Incorporates Acorn's Official Tube Host Code so that those with 2nd processors no longer need to waste a ROM socket on the DNFS.
- Option to DOUBLE the speed of BPUT and BGET.

WATFORD's & ACORN's SINGLE DENSITY DFS

Watford's popular and widely acclaimed DFS has now been available for five years and has gained a large following amongst serious and educational users of the BBC Micro. Owners of Acorn or any other standard DFS can upgrade to our "Ultimate" DFS merely by replacing their DFS ROM. See below for this upgrade. ***(P.S. Watford's highly sophisticated DFS is fully compatible with Acorn DFS). (not Acorn's 1770 DFS)***

- *Complete Disc Interface Kit including DFS ROM and fitting instructions* **£58**
- *Acorn's 0.90 DFS Kit complete* **£59**
- *DFS Manual (Comprehensive)* *(no VAT)* **£6.95**

(P.S. Our DFS manual is the only comprehensive Manual available for the BBC micro and covers both Acorn & Watford DFSs).

- *Watford's sophisticated DFS ROM only* **£16**
- *We will exchange your existing DFS ROM for Watford's Ultimate DFS ROM for only* **£12**
- *DNFS ROM only* **£17** ● *ADFS ROM only* **£25**

NEW

WATFORD's Mk II Double Density DFS INTERFACE

Many of our customers have wanted to use our superior DDFS and Acorn ADFS together. Now our MkII DDFS board has been adapted to allow the use of Acorn ADFS as well.

Added features include:

- Acorn ADFS compatible – Use ADFS on our DDFS board.
- Tube host Code – No longer any need to have the DNFS in your machine to use Co-Processors, even the CoPro and Master 512.
- Auto 40-80 Track sensing – no need to fuss with 40/80 track switches (even works with protected disks).
- An extremely powerful 8271 emulation – ensuring compatibility with almost all software.
- New low profile – small footprint board.
- Fits with all third party ROM boards.
- Option to double the speed of file handling operations – BPUT and BGET.
- Operates in both single and double density modes.
- OSGBPB has been recoded, increasing still further the speed of file handling.

Please note that not all DDFS's are capable of providing either the full 80% storage increase or of allowing a file the full size of the disk – Ours allows both of these!
If you already have a DDFS (any manufacturer), and wish to upgrade to our MkII version, then simply return your existing ROM and DDFS board and we will supply the new DDFS for only **£30.00**.

- Special introductory offer **£39.00**
- DDFS Manual (No VAT) **£6.95**
- We will exchange your existing DFS Kit for our sophisticated DDFS for only **£25.00**

Please note, as the MkII DDFS is a hardware and software upgrade, it is not possible for existing Watford DDFS users to simply exchange their ROM for the new version.

DUST COVERS (For our Disc Drives)

Single CLS (without PSU) **£3.20** Twin CLD (without PSU) **£3.85**
Single CS (with PSU) **£3.95** Twin CD (with PSU) **£3.90**

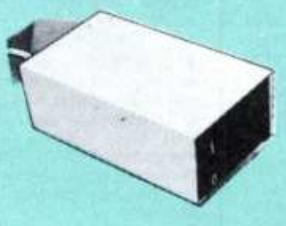
SPECIAL DISC DRIVE/DDFS OFFER

Type CLS400S

- The popular Mitsubishi 400k Single Disc Drive, Double Sided, cased with Cables. Plugs directly to your Micro.
- Watford's popular DDFS Disc Interface (allows 720k storage). Will run in both Single and Double Density modes 40/80 track Software switchable.
- A comprehensive User Friendly Manual.

A Bargain at Only **£130** (£6 carr)
(Offer valid while stocks last)

3½" DISC DRIVE OFFER



These top quality 3½" Double sided, 80 track, 1 Megabyte (unformatted each Disc Drives), are attractively finished in BBC beige. They are supplied complete with all cables and a Utilities Disc. They run directly from the BBC B/Master's own PSU.

- CLS35 400K Unit **£69**
- CLD35 800K Uni **£126**

Mysteries of Disc Drives & DFS Revealed

Are you tired of faulty cassettes, and lengthy loading times? Do you want to upgrade your BBC micro to take discs but you get tied up in the plethora of jargon surrounding the choice and use of these systems.

Then The Mysteries of Disc Drives and DFS Revealed is the book for you. It explains in detail the different types of systems available, how they are installed and how to use them. Many examples are given including pre-written programs to call various functions of the DFS available only through Operating System calls. Different types of disc, 40/80 tracks etc. are all explained. This book is ideal for the beginner confused by the plethora of choice available in the marketplace.

£5.95 (Book No VAT)

DISC ALBUMS

Attractively finished in antique brown leather look vinyl. Stores upto 20 Discs. Each disc can be seen through the clear view pocket.

£4

FLOPPY HEAD CLEANER KIT

The heads in floppy drives are precision made and very sensitive to dirt. The use of a cleaner Kit is a sensible precaution against losing valuable data. It is recommended to clean the drive head once a week. It is very simple to use. Available in 3½" & 5¼", please specify.

£6

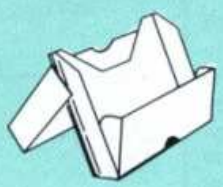
ANTISTATIC LOCKABLE DISC STORAGE UNITS

Gives double protection – Strong plastic case that affords real protection to your discs. Antistatic helps avoid data corruption whilst in storage. The smoked top locks down. Dividers and adhesive title strips are supplied for efficient filing of discs.

- **M35** - holds upto 50 5¼" discs **£6.00**
- **M85** – holds upto 95 5¼" discs **£8.00**
- **M25*** – holds upto 25 3½" Discs **£5.50**
- **M50** – holds 50 3½" Discs **£7.50**

* Not lockable

- **M10** – holds upto 10 Data Cartridges **£15**



PLASTIC LIBRARY CASES

Holds up to 10 5¼" Discs. **Only £2.00**

DISC PLONKER RACK

When using ones micro, there is a tendancy to have more than one Disc on the desk. This exposes them to the hazards of fingerprints, scratches, dust, coffee and an untidy desk.
Why not protect your valuable data from all these hazards with the help of our extremely handy and low cost DISC PLONKER RACK. It holds up to eight 5¼" Discs.

Protection at Only: **£2**

Quality Disc Drives from Watford

To help you decide which drive is the most suitable for your needs (and your pocket!), we have produced the table below.

The first capacity given in the first column indicates capacity in single density mode. That within the brackets is the capacity in double density mode. All disc drive type numbers start with the prefix "C".

The tinting on some of the boxes is used to indicate which Drives are 40 track (non-tinted) and which are 80 track (tinted). All our 80 track drives are already fitted with a 40-80 select switch.

***All our Disc Drives are Double Sided and will operate in both Single and Double Density modes**. Extensive experience of the usage of disc drives suggests that the JAPANESE drives currently represent about the best in terms of speed, reliability and overall "elegance" available for the BBC Micro.*

Various other "manufacturers" of disc drives for the BBC micro (more accurately, "packages" label other manufacturers drives with their own name). We buy the high quality JVC and Mitsubishi drives in large quantities directly from the manufacturers, package them and sell them at "dealer" prices direct to the public.

If you look around the popular BBC micro press, you will find that the prices we quote for the top quality, new slimline disc drives are, virtually without exception, some of the best around. These prices, coupled with the backup of one of the country's largest distributors of BBC peripherals provides a superb deal.

Unless you anticipate using dual drives in a fully expanded BBC system for long periods of time with little ventilation, then we suggest that our range of "CL" disc drives without the PSU (Power Supply Unit) would be quite adequate (extensive tests within our workshops have confirmed this). All drives are supplied complete with a SPECIAL UTILITIES Disc, Cables and Plugs. The Drives with power supply have a mains moulded plug for safety purposes. Ideal for Schools & Colleges. We are now able to supply all single disc drives with Power Supply, in either single or dual case. (Dual case has a twin data cable and a power supply capable of driving two disc drives) allows easy expansion to a dual drive unit, at a later date. Prices stated in the pricing boxes below are for single drives in standard single cases. Single drives in a dual case cost an extra £5. (At Watford we anticipate your needs of tomorrow, not just today)!

When using a BBC Micro, most people find themselves short of desk space. The Watford's BBC Micro plinths form an ideal way of recovering some of this precious space) your BBC, Disc Drive and Monitor can all occupy the same vertical footprint and still be comfortably situated. With the Watford Double plinth, your Disc Drive is mounted vertically at one side, leaving a very valuable area directly in front of you for such useful items as spare discs, pen, paper, reference manuals, etc. Follow the trend with Watford plinth. (Turn to the 6th page of our advert for the Plinths).
P.S. All our 5¼" Disc Drives with PSU are compatible with the Compact Micro. All you require is the special Compact Disc Drive Cables designed by us.

Capacity	Drives without P.S.U.		Drives with P.S.U.	
	Single	Twin	Single	Twin
200K (360K)	CLS 200 £89		CS 200 £98	
400K (720K)	CLS400S £82	CLD 400 £168	CS 400S £92	CD400 £188
800K (1.44M)		CLD 800S £162		CD 800S £182

● TWIN Disc Drive Case, complete with Power Supply & Cables **£43**
Securicor carriage on Disc Drives £5 to £6

Prefix ***C*** *= Cased Drive*
L *= Less PSU*
S *= Single*
D *= Double*

Suffix ***S*** *= 40-80 Switchable*

e.g. CLS400S = Cased Disc Drive, Less power supply unit, single 5¼" 400K, (720K in double density); Double sided; 40/80 track switchable.

Cable to connect 5¼" Disc Drives to BBC Compact
Single £9 Twin £12
Special Cable to connect both 3½" and 5¼" Disc Drives
simultaneously to the BBC Compact £13

3M – DISKETTES

3M – SCOTCH Diskettes with Lifetime warranty from Watford Electronics your 3M Appointed Distributor.

- *10 × 5¼" S/S D/D 40 Track Diskettes (744)* **£8.00**
- *10 × 5¼" D/S D/D 40 Track Diskettes (745)* **£9.75**
- *10 × 5¼" S/S D/D 80 Track Diskettes (746)* **£12.50**
- *10 × 5¼" D/S D/D 80 Track Diskettes (747)* **£12.75**
- *10 × 5¼" 1.6M D/S D/D High Density Discs for IBM XT and AT* **£28**
- *10 × 3½" S/S D/D 40/80 track Discs* **£13.50**
- *10 × 3½" D/S D/D 40/80 track Discs* **£15**
- *10 × 3½ High Density Diskettes* **£43**

FREE

This extremely useful and attractive Personal Leather Organiser worth upto £50 is yours when you buy from us, 5 Boxes of any of the 3M range of Discs that we advertise above.
Offer valid while stocks last.

TOP QUALITY 3½" & 5¼" DISKETTES

To complement the range of quality discs and disc drives that WE already sell, WE are now supplying some special offer packs of 10 high quality discs. Each Disc has a reinforced hub ring and carries a lifetime guarantee. These are supplied complete with selfstick labels and packaged in an attractive plastic library disc box. We strongly recommend these Discs.

- *10 × **M3** 3½" D/S D/D 80 Track Discs* **£13**
- *10 × **M4** 5¼" S/S D/D 40 Track Discs* **£6.50**
- *10 × **M5** 5¼" D/S D/D 40 Track Discs* **£8**
- *10 × **M7** 5¼" D/S D/D 80 Track Discs* **£9**
- *3" Double Sided Discs* **£3** *each*

Special BULK OFFER on 5¼" DISCS

(Supplied packed in Anti-Static Lockable Storage Units)
(Lifetime warranty on Discs)

PRICES SLASHED

BULK PACK DISCS in lots of 100

Type	S-S 40T	D-S 40T	D-S 80T
● Without Sleeves	£35	£39	£45
● With Sleeves	£38	£42	£48

WATFORD's WINCHESTER DRIVES

PRICES SLASHED

- 10 Megabyte Unit with ADFS **£375**
- 30 Megabyte Unit with ADFS **£425**

(30 Meg Unit is supplied complete with utilities software. For full details see Page 6 of our advert)

CDP800S **CDPM800S**

Twin 800K Double sided 40-80 track switchable disc drives mounted in an attractively finished Beige colour plinth for the BBC Micro. Supplied complete with integral power supply, cables and Utilities disc. The mains switch with neon On/Off light indicator, and the two 40/80 track switches are mounted on the front panel for ease of use.

CDP 800S for BBC Micro £192
CDPM 800S for Master £196
DP35-800 for BBC/Master £165
(For DP35-800S spec. see Page 4 of our advert)

(Securicor Carr. £7)
(The above drive units are 2 Megabytes unformatted)

Continued

NOMINATED FOR BRITISH MICRO COMPUTING AWARDS 1987

QUEST MOUSE

QUEST MOUSE

The ultimate in Mouse technology, the Watford Electronics Quest Mouse must be the most powerful Mouse package yet produced for the BBC Micro. Featuring state of the art 32K ROM software the Quest Mouse package is filled with features essential to the budding artist. The Quest Mouse is a high precision, low profile and large footprint mouse. It has three large comfortable buttons and its RUBBER COATED STEEL BALL is smooth and easy to use on virtually any work surface. This also eliminates any directional bias that one encounters on the most well-known mouse for the BBC. The Quest Mouse is FULLY HARDWARE COMPATIBLE with the AMX MOUSE so that it will work with any of the AMX range of software.

The two parts of the Quest package are available separately so that existing Mouse owners can upgrade to the Watford's sophisticated Quest Paint software or replace their existing worn out mice for a minimum cost.

QUEST PAINT

The Quest Mouse software is supplied on a PALPROM unit to allow the sophisticated 32K program to be used from a single ROM socket. It is compatible with the BBC B, BBC B Plus and BBC Master Series machines.

The software is used to draw high resolution Mode 1 pictures in full colour. All menu selection and control of the drawing process is performed with the mouse so that you will hardly ever touch the keyboard.

SOFTWARE FEATURES

The software is far too powerful for us to describe it fully in such a small space. Below is a list of the various features. Please write to us for a fully descriptive leaflet.

Disk interface not required. Utilities disk has facility to create and print big screens. Colours applied can be solid, either pattern of user defined pattern. Drawing can use brush or airbrush. Brush shapes can be defined and stored. Airbrush sprays colour/pattern randomly with four jet sizes and even or center spread. Colour cycles. Colour protection to stop particular colours from being overwritten by selected drawing actions. All standard drawing facilities like: rubber, straight pencil lines, triangles, circles, ellipses, rectangles, parallelograms, polygons, etc are provided. All shapes can be solid or just a boundary line. Once a shape has been set up it can be repeated anywhere on the screen. Global colour replace in a rectangle. Powerful fill facility for areas and vertical/horizontal lines. Full cut and paste of rectangular areas with rotation and size with screens from Watford Beeb Video digitiser. Load and Save screens with colour pallet information, save brush and pattern definitions etc.

Take The Guesswork Out of Selecting a Mouse Package

With reviews like this how can you go wrong.

Popular Computing Weekly, 9-11 June '87
"What you actually get for your money is a well built, three button mouse (far superior to the AMX mouse)."
"Overall the combination of a quality mouse and decent art package gives Watford Electronics a real chance of supplanting AMX as mouse supremos."

Micro User June '87
"Quest Mouse and Quest Paint can hold their heads high in the market. . ."

A&B Computing June '87
". . . Watford Electronics, a company famed for excellent hardware add ons and versatile software packages. Called Quest mouse, "this is a very special mouse driven drawing package..."
". . . you will have one of the most comfortable and professionally built mice I have used in a long time. The buttons are responsive, the mouse movement is smooth and without directional bias – a pleasure to use."
"What we have here is probably the best art package there is for the BBC Micro . . ."
"Quest Paint is a major leap forward in BBC programming. . ."
"Quest Paint is an original piece of programming, it is friendly and well endowed with many useful facilities. I would comfortably say it is easier to draw good pictures with Quest Paint than it is with more expensive 'Professional' art packages for the Atari ST and the Commodore Amiga. A recommended buy if you are looking for the best in BBC micro based art packages".

Acorn User, September '87
"The mouse (Quest) performs well in the face of competition from AMX, Wigmore and the rest . . ."
". . . this package represents excellent value for money. If you are interested in art then this program is for you to buy".
"Given time, I can see no reason why Quest Paint shouldn't take on the title of the definitive art package available for the BBC Micro to date".
"All in all, Quest Paint is a very professional package. It contains virtually every feature the budding artist could require".
"What makes Quest Paint so versatile is the addition of a sub-menu which allows you extensive control over each function".
"Until recently, Superart from AMS had been judged as the definitive mode 1 graphics package for the BBC micro. But now it has a serious rival in the form of Quest Paint, from Watford".
"As a measure of what is contained within Quest Paint, I would say it had all the features of Superart plus . . ."
"In most art packages, provision is given for drawing triangles and rectangles. Quest Mouse goes 14 better, allowing any regular polygon of upto 16 sides".
"One facility, not found on any other Art package to my knowledge, is the ability to access a digitiser from within the program".
The reviewer concludes by saying, "The result is an extremely comprehensive and professional art package".

John Kilby, Head of Computer Science, Bishop Wulstan High School, Rugby, writes:
"Quest has been an excellent piece of equipment. The problem that seems to occur everyday is that at lunchtime the pupils rush to the computer room to make sure that they are first in the queue for the 'Quest' mouse".

Lt. Cln. C.G. Holton, G2 HQ 1 (BR) Corps, BFPO 39, writes:
"As ever your service is superb and the Quest Mouse proves every bit as good as the adverts claim".

Beeblet User Group, New Zealand Oct '87:
"One of its nicer features is that the top menu is done in Mode 0, the drawing itself is in Mode 1. Thus on screen together are two different Modes. A neat way around an old problem".

"PAN is used when a larger than one screen size image is required. The mind boggles at an A3 size drawing".

"I like it partly because of the mouse itself which is smooth and easy to handle but mainly I suppose because of the features I longed for and previously never got. Its easy to use with almost everything at your fingertips from the mouse. The software is simple where needed and complex where complexity is required".

ConQuest

Watford's Quest package is an extremely powerful and flexible drawing package, with very wide and unusual features. However, since its launch various suggestions for even more advanced & powerful facilities were received from the Quest users. ConQuest allows you these more advanced facilities, like, distortion of a cutout to any shape and a full font designer. If you also have a GXR ROM in your machine or you are using a BBC Master then ConQuest will take advantage of this to give ellipses at any angle, sectors and arcs, etc. Quest combined with ConQuest and Acornsoft GXR ROM make up THE MOST POWERFUL drawing packages available for the BBC range. Quest Paint is able to take advantage of almost any additions to your machine, such as Shadow or Sideways RAM. ConQuest takes this principal even further, by utilising the otherwise normally incompatible Sideways RAM facility by holding pictures in them.
Some of the features are:

- *Pick filenames off the screen for loading and saving.*
- *Rotate a cutout to any angle and Distort it to any four sided shape.*
- *Has Built in Font editor.*
- *Default brushes and patterns on startup.*
- *16 x 16 font available on start up.*
- *Ability to reset patterns, fonts and brushes to default at any time.*
- *ROM based enhanced Epson and compatible printer dump.*
- *ROM based enhanced extended picture routine.*
- *Ability to create and abort extended pictures.*
- *Improved disk access speed for extended pictures.*
- *User definable sideways RAM driver for incompatible sideways RAM systems.*
- *Ellipses at any angle on Master 128 (or B with GXR ROM).*

QUEST MOUSE & QUEST PAINT	**£54**
QUEST MOUSE, QUEST PAINT, AMX PAGEMAKER & PAGEFONT	**£82**
QUEST MOUSE ONLY	**£25**
QUEST PAINT SOFTWARE	**£32**
QUEST FONT DISC	**£12**
ConQuest 32K ROM Package	**£29**
QUEST MAT	**£3**
Part-exchange your old Mouse for a New QUEST MOUSE for only	**£23**
GXR ROM for BBC Micro	**£22**

N.B.
1. Quest Paint supplied complete with Software in a 32K ROM, Comprehensive User Guide and a Utility Disc.
2. Quest Font Disc has 22 text FONTS for use within Quest Mouse.

MARK II LIGHT PEN

Our Mark II Light Pen is the very latest in light pen technology. It is totally insensitive to local lighting conditions and works with many different monitors. The pen only responds to the High Frequency light produced by your monitor/TV. An LED indicates when valid video data is being produced. A conveniently located switch is also fitted.

Price Only £21
(Price includes FREE software Disc and Operating Manual)

RB2 Marconi Tracker Ball

RB2 (AMX/Quest compatible)	£52
RB2 including Quest Paint	£78

FLEET STREET EDITOR

Software pack for BBC Micro	£33
Software pack for the Master	£39
Software Pack for Compact	£40
Admin Xtra Disc Utility	£13
Walt Disney Disc Utility	£13
Fonts N Graphics Disc Utility	£13

THE NEW Mk III AMX MOUSE

ONLY: £59 Inc. Super Art package
(carr £1.50)
(Please specify for BBC, Master or Compact)

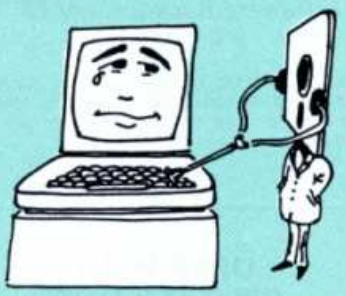
FREE our popular Colour Art software pack worth £15 with every AMX Mouse package purchased from us.

MOUSE MAT	£3
AMX MOUSE ONLY	£29
AMX UTILITY Package	£11
AMX SUPERART Package	£34
AMX STOP PRESS – A Desktop publising software. Works with Keyboard, Joystick or a mouse	£32

We are giving away absolutely FREE, our PAGE-FONT disc with every purchase of STOP PRESS from us.

PAGE-FONTS – Over 20 Fonts for use with AMX Pagemaker	£12
AMX DESIGN (ROM)	£55
AMX 3D ZICON Disc	£19
AMX XAM Educational	£15
AMX EXTRA EXTRA	£16
AMX MAX A gem of desktop (ROM)	£15

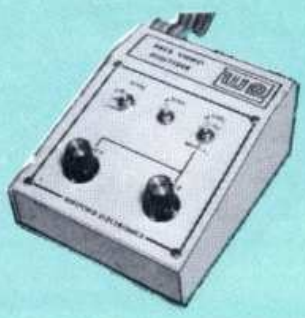
DIAGNOSTICS DISC



The BBC Micro is a very complex machine and thus diagnosing a fault can be very difficult. At Watford Electronics, we realise how difficult it can be when faced with a problem, finding yourself a long way from your nearest dealer, or even just uncertain about your Beeb's health, but not wanting to waste time and money taking it to be looked at.
The solution to these problems is here now, in the form of the Watford's Diagnostics Disc. This excellent utility is specially designed to test out the following areas of your Beeb:
RAMs, ROMs, ULAs, Sound, Keyboard, Disc, RS423, ADC, User Port, Printer Port, Cassette, Joysticks, Speech, Disc Drives, 6502 and Z80 2nd Processors.
This utility is an invaluable aid for all those who take the reliability of their system seriously. A comprehensive manual provides full operating details and a list of possible causes and remedies for any faults that you may find along the way. The package also enables a permanent equipment and service record to be maintained.

Only £20.00

BEEB VIDEO DIGITISER



Using any source of composite video (colour or monochrome) and the Watford Beeb Video Digitiser, you can convert an image from your camera into a graphics screen on the BBC Micro.

This uses the full graphics capacity of the BBC micro in modes 0, 1 or 2. The video source may be a camera, video recorder or television, and is connected via the video output socket.

Images produced can be compressed, stored to disc, printed on an Epson compatible printer, directly used to generate graphics, analysed for scientific and educational use or converted to other formats e.g. Slow Scan TV or receiving a picture from a remote camera using a modem.

The output from the digitiser exactly matches the graphics capability in each mode, with up to 8 levels of grey in mode 2. The unit connects into the User Port and automatically scans a complete picture in 1.6 seconds.

Both the black and white levels can be adjusted manually for the optimum picture, or switched to automatic for unattended use. The image produced can be reversed if necessary.

Full controlling software is supplied on a normal sideways ROM and this is easily accessed via additional * commands. The package i designed to allow easy input of complex screens and give full access of the data to the user. Once on the screen, the image can be used as a normal graphics screen, allowing any of the usual graphics commands in BASIC or other ROMs to work on it.

A special print dump routine is included with the driver programs. This is specially designed to produce a fast, correctly proportioned picture, with reduced "contouring", resulting in an accurate reproduction of the original image.

Detailed examples of driving this unit from BASIC or other languages are all provided in the extensive manual supplied.

£109 (Carr. £3)

(Price includes) Digitiser Unit, Software in ROM & a Comprehensive Manual)
(BBC B+ and Master compatible, except Master with Econet)

Magazine Maker

(As seen on TV)
A combination of the Pagemaker and Watford's Beeb Video Digitiser.

Using any video that provides a composite signal and the digitiser, images from a camera or TV can be converted into a graphics screen on the BBC Micro.

They can then be used within Pagemaker to illustrate magazines or newsletters – in fact anything that needs to be created on A4 size paper.

With Pagemaker's many features, a variety of pictures can be composed – the only limit being the imagination.

Pictures can be doctored using Pagemaker's graphics option to produce any number of effects.

Text can be formatted around the digitised photo on screen using the facilities available, which include 16 typefaces, character and pattern definer, text formatting and the ability to load in wordwise and viewfiles plus much more.

Once created the picture can be printed out.

The Magazine Maker is suitable for any use that requires illustrated documents.

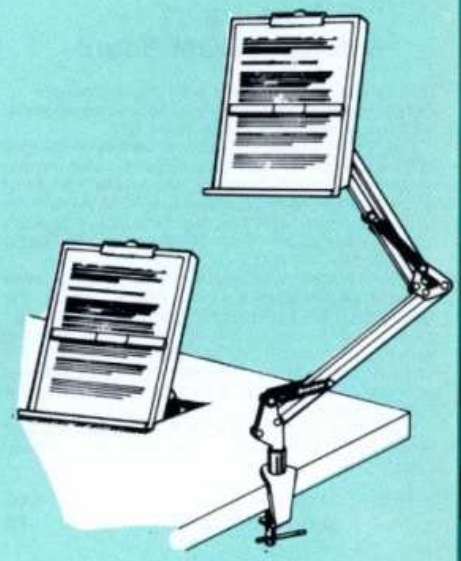
Complete Package **£135.00** (carr. £3)

PLINTHS FOR BBC MICRO, MASTER & PRINTERS

Protect your computer from the weight and heat of your monitor. The BBC micro plinths have slots for maximum ventilation. The single plinth is suitable for a BBC and monitor, whilst the double height version provides enough room for our stacked or side-by-side dual disc drives or TORCH Disc pack, to be placed in the centre section. If you use our stacked drives, the remaining space can be used for further peripherals e.g. Speech Synthesizer, EPROM programmer or simply stationery. The computer slides neatly in to the lower section allowing easy access to remove the lid. The printer plinth is equally sturdy but without the cooling slots. It allows for access to the paper from the front as well as from the rear, (a facility not often thought of in similar products) if the paper is located beneath the plinth. This is a very convenient way to work especially if your work area is not deep enough to take the printer and paper separately.

SINGLE BBC PLINTH	**£11** (carr. £1.50)
DOUBLE BBC PLINTH	**£19** (carr. £3.00)
PRINTER PLINTH	**£10** (carr. £1.50)
SINGLE MASTER PLINTH	**£14** (carr £1.50)
DOUBLE MASTER PLINTH	**£24** (carr £3.00)

COPY HOLDERS



How often have you been about to type hand written notes into your computer when you find that there's nowhere to rest the paper or that your notes are resting at the wrong angle to read the type? Whether the notes be your latest program or the draft of a new trilogy, the new Manuscript Holders from Watford are superb for holding your paper at the ideal height and angle to allow you read and type in ease and comfort.

Available in 2 versions, desk resting and shelf clamping versions, these two units hold your paper firmly by means of a plastic retaining ruler and a clip grip. Both units are full A4 size.

Amazing value at only
Desk Top **£10** (carr. £2)
Angle poise **£14** (carr. £3)

Continued ——→

ARIES CORNER

The Aries B-32 Shadow RAM Card

Like the BBC B+, the B32 provides 20k of shadow screen RAM and 12k of sideways RAM. Unlike the B+, the B32 has simple software commands which allow the user to reconfigure the RAM as 16k of shadow RAM and 16k of sideways RAM, or all 32k as sideways RAM.

With the B32, the programmer gets up to 28k of RAM available for Basic, Logo, Comal, Forth, Lisp and BCPL programs in any screen mode. The business user gets extra memory for View, ViewSheet, Wordwise Plus, Interword and many other applications. For advanced applications, the scientific user gets access to a massive 47k of data storage using the Acorn approved *FX call.

Sideways RAM enables you to load sideways ROM images from disc, allowing you to have a large library of sideways ROMs (subject to the copyright holder's permission) stored on disc. The B32's sideways RAM can also be used to extend any operating system buffer (such as the printer buffer) or to load tape programs into a disc system.

The B32 simply plugs into the 6502 processor socket on your BBC micro – no flying leads to connect and no soldering. Provision of the on-board ROM socket means that the Aries-B32 control ROM does not use up one of your existing ROM sockets.

● Recommended by Computer Concepts for use with their Inter series of ROMs.

Price: **£80** (carr. £2)

CREDIT CARD 24 HOUR
Ansaphone Hot Lines
(0923) 50234 or 33383

Aries B-12 Sideways ROM Board

This board is extremely well made, simple to install, reliable when fully loaded and compatible with the Aries-B20 and the Aries-B32

The B12 provides a total of twelve sideways ROM sockets (the four in the original machine are replaced by the twelve on the board), all fully accessible by the MOS sideways ROM system. In addition, there are two sockets for sideways RAM, giving up to 16k of RAM using 6264 static RAM chips.

The B12 system consists of two parts: a large detachable "mother board" which carries the extension ROM sockets and a small "base board" on a short ribbon cable, which plugs into the existing sideways ROM sockets. This two-board design eliminates the reliability problems previously associated with some other ribbon-cable based systems.

If you do not have a B32 or B20, a small adaptor module (the Aries-B12C) is available at a nominal cost.

Price:	Aries B-12	**£40**
	Aries B-12C	**£5**

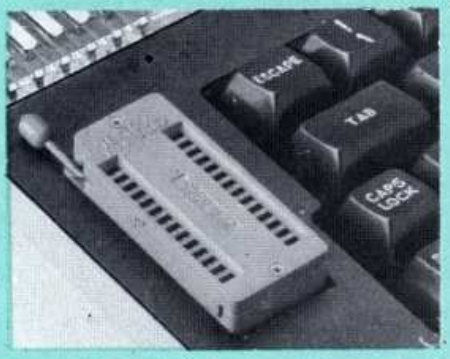
ARIES B-488 IEEE-488 INTERFACE UNIT

The Aries-B488 is an interface unit to enable the BBC micro to control and monitor IEEE-488 bus systems. The IEEE-488 bus (also known as the 'GPIB' or 'HP-IB') is the standard method of interconnecting programmable laboratory instruments and control equipment. Using the B488, up to 15 devices may be connected in a single high-speed data network.

£238 (Carr £3)

All prices in this advert are exclusive of VAT.

SIDEWAYS ZIF SOCKET



Allows you to change your ROMs quickly and efficiently, without opening the lid. The ZERO INSERTION FORCE (ZIF) socket is located into the ROM Cartridge's position.

● Very simple to install. NO SOLDERING required. The ZIF (Zero Insertion Force) eliminates the possibility of damage to your ROM pins when inserting & extracting.

● The low profile of the socket allows unrestricted access to the Keyboard.

● All data and address lines are correctly terminated to ensure correct operation of suitable ROMs with the BBC micro. We also supply a purpose designed see-through storage container with anti-static lining, allowing you to store up to 12 ROMs, protecting them from mechanical and static damage.

● This versatile hardware solves the problem of running out of socket space. Simply lift the ROM from the ZIF & insert a different one (No pulling or pushing of Cartridges. It is a must for all professionals and Hobbyists alike.)

● BBC, B+ and Master compatible.

ONLY **£16** (carr £2)

Low Profile CARTRIDGE SYSTEM

Complete System consists of: Low profile ROM Cartridge, Socket housing, Cable assembly, 5 labels and a library storage rack for the BBC B.

● Complete System	**£11**
● Spare Cartridges	**£2.50**
● Spare Rack	**£1.50**

ROM Cartridges for the BBC Master
Twin **£7.50**; Quad **£11**

16K Sideways RAM Modules

Complete with such features as read and write protection, these new modules from Watford Electronics are ideal for the hobbyist, software developer and ROM collector.
Key points to note about this new addition to the Watford range of products are:

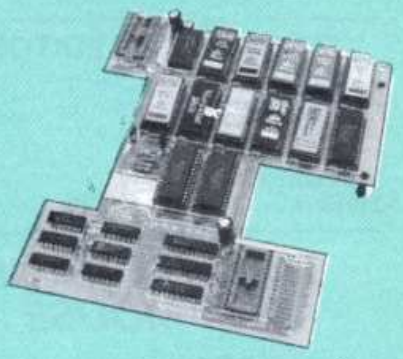
● Write protection (useful in a variety of circumstances).
● Read protection (allows recovery from ROM crashes).
● Compact construction.
● May be fitted in systems even with a ROM board.
● Multiple units may be fitted, even with a ROM board.
● No overheating or overloading problems.
● Free utilities disc supplied.
● Can be used as a 16K PRINTER BUFFER.
● Ideal for professional software development.
● Supplied with utilities software disc.

Only: **£24** (carr £2)

Optional extras

READ and WRITE protect Switches **£2** each
Battery for Battery Backup **£3**

SOLDERLESS SIDEWAYS ROM SOCKET BOARD



In the May 1986 Micro User's independent review, the writer concludes, "The board has been well laid out. Its position is much better than others – not over the HOT RAM chips and further away from the disc controller area". "I give the solderless ROM board the thumbs up and wish it success".

This brand new board from Watford Electronics is designed specifically for those wishing to add a ROM board to their own BBC without the need to perform any soldering.

This new board expands the total possible number of ROMs in a BBC from 4 to 16.

Unlike our competitors inferior boards, the ONLY upgrade required for fitting battery backup to the Watford Solderless ROM board (all Watford ROM boards, actually) is the fitting of the battery itself. (No other expensive components are required.)

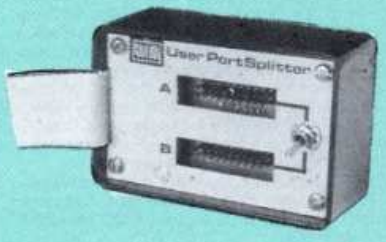
● The key features of this new, no fuss, easy to install quality product from BBC leaders Watford Electronics are as follows:
● Increase your BBCs capacity for ROMs from 4 to 16.
● **No soldering required.**
● Very low power consumption.
● Minimal space required.
● Compatible with Torch, DDFS, RAM Card, 2nd Processor, etc.
● Socket 14 takes two 6264 RAM chips.
● Read protect to make RAM "Vanish") allows recovery from ROM crashes.
● Battery backup option for RAM chips.
● Supplied ready to fit with comprehensive instructions.

Price: Only £32
Battery backup fitted **£36**
Battery Backup only **£3**
(carriage £2)

● Sideways RAM Utilities Disc for Solderless ROM Board. Includes the options to load and save ROM Images and the facility to use Sideways RAM as Printer Buffer.

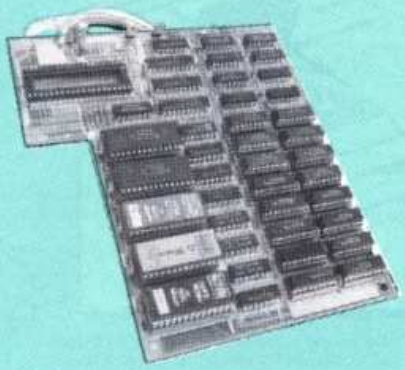
Only: £8

USER PORT SPLITTER UNIT



Gone are the days when you had to plug and unplug devices from the User Port. This extremely useful little device allows two units to be connected to the User Port simultaniously, and select between them simply by toggling a switch. This device is particularly useful for those people using Quest Mouse and the Watford Video Digitiser or any similar combination.

ROM/RAM CARD



Watford Electronics announced the first ever commercial ROM board for the BBC micro, the Watford Electronics 13 ROM Socket Board 3 years ago. Following the success of this board, we have designed what probably represents the ultimate in expansion boards, the new Watford Electronics ROM/RAM board. This highly versatile and sophisticated board represents the latest in "2nd generation" sideways ROM technology for the BBC micro, designed to satisfy the serious BBC user.

- NO SOLDERING required to fit the board.
- NO overheating problems.
- No User Port corruption (avoids problems with the mouse, modems, Eprom Programmers, etc.)
- Fully buffered for peace of mind.
- Firm mounting in BBC micro.
- Compatible with all BBC micros (not BBC+ or Master).
- Total number of ROMs increased from 4 to 8.
- Up to 8 banks of sideways RAM (dynamic).
- Option for 16k of Battery backed CMOS RAM (CMOS RAM needs one ROM socket).
- Software Write protect for ALL RAM.
- Read protect for CMOS RAM (ALLEVIATES crashes during ROM development).
- Separate RAM write register (&FF30 to &FF3F).
- Automatic write to currently selected RAM socket for convenience.
- Accepts any ROM.
- FREE utilities disc packed with software.
- Compatible with our DDFS board, 32k RAM Card, Delta Card, sideways ZIF, etc.
- Large printer buffer.
- UNIQUE Fully implemented RAM FILING SYSTEM (similar to the popular Watford DFS).
- ROM to RAM load and save facilities.

The SFS (Silicon Filing System) can utilise up to the full 128k of RAM (with the SFS in any paged RAM) as a SILICON DISC. This behaves as a disc drive, with all the normal Watford DFS features (including OSWORD &7F for ROM-SPELL, etc.) to provide an environment that looks like a disc but loads and saves MUCH faster.

The ROM-RAM Board plugs into the 6502 CPU socket. This leaves free all the existing ROM sockets, which can still be used normally.

Any ROM that can be plugged into the BBC micro's own ROM sockets may be used in the ROM-RAM Board.

The ROM-RAM Board is supplied with all ordered options fitted as standard. Upgrade kits (with full instructions) are available for all of the options, for later.

Please write in for further details.

INTRODUCTORY PRICES:

- ROM/RAM card with 32k dynamic RAM ***£45***
- ROM/RAM card with 64k dynamic RAM ***£59***
- ROM/RAM card with a massive 128k dynamic RAM **£89**

(carriage on ROM-RAM Card £3)

OPTIONAL EXTRAS:

- 16k plug-in Static RAM kit **£9**
- 16k Dynamic RAM for Upgrade **£9.20**
- Battery backup **£3**
- Read and Write protect switches ..... **£2** each

Complete ROM-RAM board
All options installed **£106**

P.S.
Is your existing ROM Board overflowing with ROMs? Do you need more Sideways RAM? Is your Board unreliable? Then upgrade to Watford ROM/RAM Board and pay £5 less

Le Modem

The MODEM from Watford

At last a professional MODEM for the BBC Micro. Unlike other 'Modem packages' this is a complete package there are no extra software costs to get 'up and running'. Of course Le MODEM is multi-standard, i.e. 300/300, 1200/75 & 75/1200 UK and BELL (USA) are all supported.

The features that make Le MODEM such good value are:

- *A complete communications terminal that transforms your BBC Micro into a very powerful World-wide data transfer system.*
- *Auto Dials, Auto answers, and is completely controlled by your micro. There are no external controls!*
- *Allows you to access PRESTEL, B.T. GOLD, THE SOURCE, MICROLINK, MICRONET, MICROWEB, THE TIMES NETWORK, MICRO LIVE (BBC TV database), CITY BB and more.*
- *Designed to be SIMPLE but SOPHISTICATED. To LOGON to a data base all you have to know is its TELEPHONE NUMBER, Le MODEM does the rest.*
- *Supplied with a comprehensive telecomms package in a 16K sideways ROM which includes a FULL PRESTEL terminal allowing TELE-SOFTWARE to be downloaded.*
- *A comprehensive 80 column terminal. This includes XMODEM error checked transfer protocol, to allow error free data transfer anywhere in the world!*
- *FULLY controlled by simple '*COMMANDS allowing you to control it from your own BASIC programs. To get you started we supply a FREE disc of bundled software!*
- *Connects to the 1MHz bus. A *AUDIO ON-OFF command allows you to actually hear the telephone line through your BBC micro loudspeaker.*
- *Completely self contained with internal mains power supply. (Even a free mains plug is fitted!) A *TEST facility gives ON SCREEN indication that Le MODEM is working correctly.*
- *Packaged in such as way that you need nothing else except a BBC Micro to communicate with computers all over the world.*
- ***FREE Registration to MicroLink.***

SPECIAL OFFER

Price: ***£82*** *(carr £3)*

(Price includes, Le Modem, Software ROM, Cables & Comprehensive Manual)
(Write in for further details)

REPLICA 3

This new improved REPLICA 3 from Clares is a very powerful disc based TAPE to DISC Utility. It now transfers even more programs than ever before. Replica 3 will not work with all programs but then neither will anything else. 30,000 Replicas have been sold to date. It has to be good.

£15 (40 or 80 track)

Acorn's Speech Synthesiser package, complete
Special Offer £18

APOLLO

The NEW Modem from Watford

Following numerous requests from you, our discerning customers for an APPROVED, Low Cost & High Performance modem with Auto Dial & Auto Answer facilities as standard) we bring you the versatile APOLLO Modem. Just compare the features and look at the price (which incidentally includes the cost of the Software, manual and BBC connecting cable). We are sure you will agree that Watford Electronics in their traditional way are giving you a super 'value for money' deal.

Just look at these features:

- V21 for Bulletin boards, Microlink, Telecom Gold, etc.
- V23 for Prestel, Home Banking, and other Viewdata services.
- Reverse V23 allows User run Viewdata service.
- 1200-1200 half duplex for communications.
- XMODEM, HEX and ASCII file transmission.
- Auto Dial of given 'phone number.
- Auto Answer for User's Bulletin Board.
- 80 column terminal with split screen facility.
- Prestel text screen dump.
- Fully BABT approved.
- **FREE Registration to MicroLink.**

The Apollo is attractively finished in matt black. It opens the doors to world communication to both, the Hobbyist and the Professionals alike. With baud rates varying from 300/300 Originate and Answer, 1200/75 and 75/1200 full duplex and 1200/1200 half duplex, virtually all the popular tele-services can be accessed. A comprehensive Comms ROM oversees the use of the APOLLO, providing simple commands for all the software controlled facilities. APOLLO is an ideal modem for both the first time buyer and the seasoned user. Join the Telecommunications Revolution – Buy a Watford APOLLO!

Only: **£82** **(Carr £3)**

Price includes, the Modem, Comm Software Cables & Operating Manual).
(Write in for full specification)

VOLTMACE JOYSTICKS

Delta 3B Single Joystick	**£12**
Delta 3B Twin Joysticks	**£17**
Delta 3C Joystick for Compact	**£10**
Delta 14B Single Joystick	**£12**
Delta 14B/1 Adaptor Module	**£12**
Transfer Software Disc-Tape	**£7**

ATTACHE CARRYING CASE

For the BBC Micro. Attractively finished in antique brown leatherette. Lockable.

Only **£10** (£2 carr.)

Versatile BEEB SPEECH SYNTHESISER Unit

The Watford Speech Synthesiser is a very flexible speech synthesis unit based upon the powerful phonemes system. This system stores the building blocks of speech (called phonemes) and allows you to combine them quickly and easily to form virtually any word imaginable.

Supplied with an advanced ROM, you are provided with a 500 word dictionary to get you started. These can easily be added to by following the notes given in the comprehensive manual.

SPECIAL PRICE £32 (carr £2)

Continued

COMPUTER CONCEPT'S ROMS

ACCELERATOR	£46
CARETAKER Basic Utility	£23
DISC DOCTOR	£28
Graphics ROM	£29
TERMI	£25
COMMUNICATOR	£49
SPEECH ROM	£24
Printmaster	£25

Wordwise £23

Wordwise plus £40

We are giving away absolutely **FREE**, the superb Word-Aid ROM worth £24, with every WORDWISE PLUS package bought from us.

Word-Aid

The most comprehensive utilities ROM for Wordwise-Plus

Extend the power of your Wordwise Plus word processor with this most advanced ROM from Watford. By utilising the powerful Wordwise Plus programming language, WordAid provides a whole host of extra features, all accessed via a special new menu option. This ROM has been personally approved by Mr Charles Moir, the author of WORDWISE PLUS.

- Alphabetical sorting of names and addresses.
- Text transfer options.
- Chapter marker.
- Epson printer codes function key option.
- Search and display in preview mode.
- Embedded command removal.
- Print Multiple copies of a document.
- Multiple file options for print and preview.
- Address finder.
- Label printer.
- Mail-merger.
- Number/delete/renumber.
- Clear text-segment area.
- BBC B, B+ and Master compatible.

Only **£24**

(N.B. Word Aid requires a Disc Interface in your Micro)

HI-WORDWISE-PLUS DISC: £5

SPELL MASTER £42

Inter SHEET ONLY £37

INTER CHART ONLY: £25

Inter-WORD £36

MEGA-3 ROM

Interword, Intersheet & Interchart – 3 in one ROM **£76**

INTERBASE £49

All Prices Exclusive of VAT

VIEW

VIEW WORDPROCESSOR 2.1	£35
VIEW 3.0 ROM	**£48**
VIEW PROFESSIONAL	**£79**
HI-VIEW (for use with 6502 2nd Processor)	£36
VIEWSHEET (Acornsoft)	£36
VIEWSTORE	£36
VIEWSPELL with 80 track disc	£29
VIEWPLOT Disc (Please specify for Master 128 or Compact)	£20
VIEW-INDEX	£12
OVERVIEW Packs 1 & 2 for the Master	£72

Watford's own Sophisticated VIEW PRINTER DRIVERS

Epson FX80 & Kaga KP (Disc)	£8
Juki & Brother HR15 (Disc)	£8
Silver Reed Printers (Disc)	£8

MINI OFFICE II

DISC Version for BBC B & B+	£14.00
DISC Version for BBC Master	£16.50
ROM Version	£43.00

(When ordering please specify for which Micro & 40 or 80 track Disc).

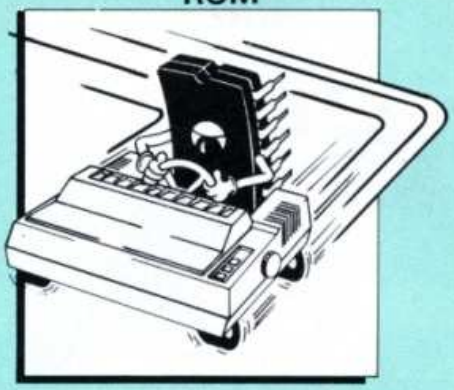
Harness the full potential of your Epson RX or FX printer. The NLQ ROM makes Epson printers produce Near Letter Quality output with optional proportional spacing, enlarged and underlined. Accessed by simple * commands from Basic, Wordwise and View (with driver) or almost any other language.

(Send an SAE for sample printout)

Only: £25

VIEW PRINTER DRIVER for NLQ ROM £7

VIEW PRINTER DRIVER ROM



View is a powerful word processor, but until now has seriously lacked in terms of printer support. With the launch of our Printer Driver ROM, which includes an extremely powerful and easy to use Printer Driver Generator, View users can find themselves in the realms of advanced word processing only at a small outlay.

The VPD extends View's printer command with a series of mnemonic commands. All standard highlight sequences are also supported. A large range of printers are supported by drivers contained within the ROM (the drivers can be downloaded and customised). Printers supported include: Epson's MX, RX, FX, FX, LX, JX80 range, HI80, KP810/910, PW1080, JP101, HR15, M1009, GLP, Panasonic KX-P1081/2, JUKI 6100, etc.

Other printers are readily supported by defining a Printer Driver using the built in Printer Driver Generator. The features mentioned below are available to both the built in Printer Drivers and user defined drivers (assuming the printer supports the features).

NLQ control, Underline, Bold, Proportional Spacing, Microspacing, Italic, Superscript, Subscript, Condensed, Enlarged, Double Strike, Set lines per inch numerically (e.g. LPI 6), Set characters per inch numerically (e.g. CPI 5), Select printer font, Select printer ribbon colour, Translation sequences, Emulation of BBC Character Set, Simple numeric expressions for certain operations, Full printer setup, Send control codes, Print prompt on screen, Redefinable Pad character, Pause for key press, Prompt to change daisywheel, and Execute * command when printing.

Other features include a very powerful on screen preview, with bold, italic, underline, super/subscript, enlarged highlights, and a special printer driver to allow memory based text to be previewed by View 1.4. Of course, View 1.4, 2.1 and 3.0 are all supported, as is Shadow RAM and 6502 Second Processors. The BBC B series and Master series of micros are supported. A comprehensive manual is supplied. All in all, a very professional product for the discerning user who wants power at their finger tips. (Write in for a detailed leaflet).

Price: Only £33

ROM-SPELL

Probably the most advanced and fastest spelling checker available for the BBC Micro. Compatible with View, Wordwise and Wordwise Plus ROMSPELL is simple to use with easy editing of incorrect words. Full facilities for editing the user dictionary to allow customisation to your personal needs. Dictionary includes over 30,000 words and is supplied with a Comprehensive manual.

NOT compatible with 1770 DFS.
(Please state 40 or 80 track disc)

Price still only: £25

DUMPOUT 3

A highly sophisticated screen dump ROM. This has to be the most flexible and powerful screen dump ROM yet produced for the BBC micro. It will put on paper anything you see on the screen, including full Mode 7 graphics. Also provided are window setting utilities and OSWORD calls to plot and read Mode 7 graphics pixels.

Facilities:

- Vertical and horizontal scaling in all graphics modes and mode 7
- Rotation of image by 90, 180 or 270 degrees
- Left hand margin setting
- Screen dump window setting
- Colours appear as grey scale
- Two tone fast dump
- Colour mask
- Mode 7 contrast expansion
- Mode 7 contiguous dump
- Key triggered and User Port triggered dumps

The Micro User Feb. 1985.
'Without reservation I wholeheartedly recommend the Dump Out 3 ROM as the ultimate screen dump facility for the BBC Micro . . . it must represent excellent value for money and surely cannot be beaten".

For use with the following printers:

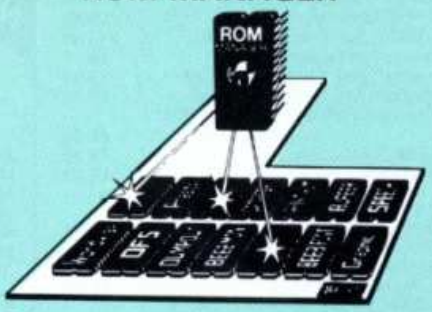
GLP, GP80/100/250, CANNON, STAR, KAGA/TAXAN, NEC, SHINWA CP80, GEMINI, EPSON MX/RX/FX, M1009, NEC PC8023, DMP100/200/400, Panasonic KX1081/82, Mannesman Tally and compatibles.

Only: £25

BBC SOFTWARE'S Popular Educational Software

- Maths with a Story 1 (Disc). 4 primary level maths programs **£11.25**
- Maths with a Story 2 (Disc) 4 further maths programs **£11.25**
- Picture Craft (Disc) 6 - 14 age group. Pack consists of flexible geometrical design & colouring programs **£17**
- WAVES: Science Topics (Disc) CSC O Level Physics program. **£14.95**
- RELATIONSHIP: Science (Disc) O Level Biology program. **£20.00**
- BONDING: Science (Disc) O Level Chemistry program. **£20.00**
- ELECTROMAGNETIC SPECTRUM (8 Discs) O Level program. **£20.00**
- ELECTRONICS IN ACTION (Disc) O Level program **£19.95**
- NEWTON & THE SPACE SHUTTLE (Disc) O Level program. **£20**
- ECOLOGY (Disc) O Level program. **£20**
- POLYMERS (Disc) O Level program. **£20**
- Clasification & Periodic Table O Level. The suite is supplied with its own database of chemical elements which can be classified according to your own rule. **£20**
- FOOD & POPULATION (Disc) O Level program. **£20**
- MICROTECHNOLOGY (Cassette) O Level program. **£11.25**
- A VOUS LA FRANCE (2 Cassettes) A French language home study aid. **£21.70**
- DEUTSCH DIREKT! (Disc & Audio Cassette) **£19.95**
- Modem Master (Disc) **£11.25**
- ADVANCED TELETEXT SYSTEM **£8.65**
- PERIOD TABLE SOFTWARE **£20**
- Astronomy – Primary (Disc) **£12**
- Computers at Work – Primary **£17.35**
- Introducing Geography – Primary **£17**
- **Introducing Geography 11-17yrs** **£17.50**
- Electric Fields 6-14 years **£11.25**
- BlackQueen Contract Bridge **£13**
- Espana Viva – 3 Discs **£19.95**
- A Vous La France Disc **£21.50**

ROM MANAGER



Take control of your Sideways ROMs with ROM Manager. This powerful utility ROM gives you power over your sideways ROMs. Disable whole ROMs, send commands directly to named ROMs and many other powerful facilities.
"Provides comprehensive management of all your installed ROMs". (BEEBUG November '84.)

ONLY £20

ADDER

The only low cost EPROM Programmer for the BBC Micro that will program both the standard 21V and the new 12V5, 27128 EPROMS. Adder is the ultimate EPROM programmer for the BBC Micro. It will program many different EPROMs up to the very latest 27256 32K devices.
The Adder unit connects to the User Port and draws its power from there too. The EPROM is mounted in a top quality ZIF socket. There are no switches or controls as Adder is entirely software controlled.
The Adder software provides sophisticated facilities for programming EPROMs from a RAM image produced by loading disc files. The software is menu driven and designed for ease of use.
Features:

- Two ultra fast programming algorithms or standard slow algorithm.
- Supports standard 21V programming and newer 12.5 volt EPROMs. (Software switched).
- The RAM image to be programmed can be built up in many ways. Sections of image can be loaded separately. Part programming. Read EPROM. Edit data in memory.
- Automatic processing to handle a list of files to program into the EPROM.
- Automatic disc buffering to allow programming of 32K 27256 devices from a 32K file without extra effort.
- Verification gives detailed error list and checksums are maintained. There is also a blank check facility.
- Works with all standard filing systems. Generates header code for RFS ROMs to allow Basic programs etc. to be stored in EPROM. More than one file per ROM permitted.
- Programs the following EPROMs: From 2K to 32K: 2516, 2716, 2532, 2732, 2764, 2764A, 27128, 27128A, 27256 (Both 12.5V and 21V).

£75 (£3 Carr)

TEX EPROM ERASERS

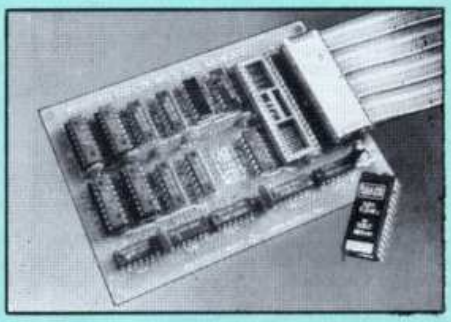
EPROMs need careful treatment if they are to survive their expected lifetime. Over erasure of EPROMs very rapidly turns them into ROMs! The TEX erasers operate following the manufacturers specifications to give the maximum possible working life by not erasing too fast. We use these erasers for all our own erasing work.

- **ERASER EB** – Standard version erases up to 16 chips. **£28** (carr £2)
- **ERASER GT** – Deluxe version erases up to 18 chips. Has automatic safety cut-off to switch off the UV lamp when opened. **£30** (carr £2)
- Spare UV tubes. **£9**

32K

SHADOW RAM- Printer Buffer

Expansion Board



A MUST FOR WORD PROCESSING

Watford Electronics now brings you the latest state-of-the-art MEMORY EXPANSION BOARD for your BBC microcomputer. Don't throw away your BBC B for a BBC B Plus or BBC Master. Just plug the ribbon cable into the 6502 processor socket, and fit the compact board inside the computer. Immediately you will gain not 16K or even 20K, but a massive 32K of extra RAM!!!

- IMPROVE your WORD PROCESSING system, whether disc or cassette based. Don't wait for a slow printer – type in text while printing. TWO JOBS DONE SIMULTANEOUSLY and £100+ saved on a printer buffer.

- "VIEW" Wordprocessor users can now type in letters in 80 columns and have up to 28,000 bytes free – 5 times as much as normal.

- In WORDWISE (or WORDWISE-PLUS), preview in 80 columns with the full 24K of text in memory. This product is recommended as an ideal complement by Computer Concepts.

- Combine GOOD GRAPHICS and LONG PROGRAMS. Use the top 20K of the expansion RAM as the screen display memory, leaving all the standard BBC RAM free for programs. Benefit from MODE 0/1/2 graphics and 28K of program space.

- Use the FULL 32K or the bottom 12K of the expansion RAM as a PRINTER buffer for PARALLEL or SERIAL printers, sound channels, RS423 etc. Print large text files while running long graphics programs, and have all your buffer options available as well (*FX15,21,138,145,ADVAL etc). Please note only a 12K printer buffer can be used with Wordwise or Wordwise-Plus, due to the way they are written.

- Unique facility to turn ROMs off and on again. Unlike all other ROM managers, this feature does not use 'unofficial' memory. Two bytes of normally user-inaccessible memory on the RAM card are used to ensure ROMs are disabled WHERE OTHER ROMS FAIL.

- Recommended by Computer Concepts for use with their Inter series of ROMs.

Only £59 (carr £2)

(Price includes a comprehensive manual and the ROM)

INCREDIBLE WORDPROCESSING DEAL

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at Only **£89** (carr £2)

Continued ——→

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NEW

THE COMPLETE BBC COMPUTER USER HANDBOOK

"Why has no-one written a book like this before? It's long overdue".

If you own a BBC-B, BBC B+, Electron, Master 128, Master Compact or Archimedes then this book is for you. It shows you how to get the most from your computer, and how to make the computer work for you. Although some sections are machine specific, most of the information, programs, hints and good solid experience are for the whole range of BBC machines. The general style and level means that both beginner and expert will feel satisfied with the quality and quantity of the material.

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HARDWARE – How to design your own work station. Hardware additions (disc drives, ROMs, printers, 2nd processors, etc). DIY alterations.

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At last Acorn's long awaited Advance Reference Manual for the BBC Master Series of Microcomputers has now been published. Watford Electronics' own authors have edited and added missing sections to the original script and produced a very high quality publication.

It features information about:

- Memory Organisation
- Slow data bus
- Detailed circuit description
- Keyboard controller
- Screen display
- User port
- Serial Processor
- Peripheral bus controller
- 1 Mhz Bus
- Machine operating System
- Second processors – Internal, Z80 and 80186
- Disc Filing Systems
- ANFS
- Terminal Emulator & Editor
- View internal format
- Detailed differences between Model B, B+, Master 128K and Compact
- Comprehensive appendix on 65C12 instruction set

At the rear of the manual there are pull out circuit diagrams for the Master 128K.
A worth-while addition to any Master owner's library.

All this for just £19 (NO VAT)

THE WAPPING EDITOR

Watford Electronics bring professional quality Desktop Publishing to the Beeb. The Wapping Editor is a totally self contained mouse-driven desktop publishing package designed to run on the BBC B, B+ and Master computers. The massive 64K ROM contains ALL the software you need to do your own publishing. It 'Brings the Freedom of Press' to your fingertips. Its salient features are:

Graphics Package
This section is a fully functional word processor specially tailored to suit the Desktop Publishing environment. Gone are all the unnecessary and cumbersome text formatting commands – these are dealt with in the 'Page-Layout' section. Text input can of course be taken from existing word processor files like Wordwise, View, etc.

Page-Layout Section
Page Layout becomes easy using these mouse-driven routines. The user simply 'pulls' a rectangle onto the page and states which text document or graphic is required to fill the space – it's as simple as that! Text can be automatically printed in a pre-set number of columns, left justified and/or right justified, or centered. Several different typefaces can be held in memory at one time. Graphics may be stretched, squashed or cropped to fit any size rectangle. Graphics input can be from the software provided in the package or, using the 'mode convert', from any graphics mode screen.

The Font Editor
Allows editing of ALL 95 characters. As well as being able to design your own typefaces, fonts from other DTP packages or from Quest Paint may be loaded into the editor and converted for use with the Wapping Editor. Some of the numerous functions including slide, flip, invert and rotate individual characters or the whole font. Individual characters can be mirrored or copied and a mask feature allows you to superimpose two characters. Lines and columns can be inserted or deleted allowing the character to be stretched or squashed.

This package is the latest in the line of integrated professional quality mouse-driven software from Watford.

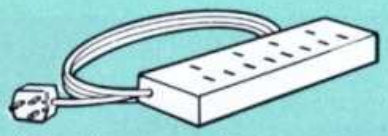
P.S. For details on Quest Paint and ConQuest, please refer to Page 7 of our advert.

SURGE PROTECTOR Plug

Fitted in place of your normal mains plug, this device protects your equipment against mains surges. Nearby lightning strikes, thermostats switching and many other sources which put high voltage transient spikes on to the mains. This can lead to data corruption in memory and on disc and can result in spuriously crashing machines. A must for every computer user.

Protection for only **£7.50**

4 WAY MAINS DISTRIBUTION SOCKET



4 way top quality mains trailing sockets. Supplied wired up with mains plug ready for use. Can be screwed to floor or wall if required. Very useful for tidying up all the mains leads from your peripherals.

£7.95 (carr £1.50)

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A 4 way mains distribution unit as above with a built-in Surge Arrester, providing protection for your complete computer system

£13.00 (carr. £1.50)

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£2

Replacement FLEXIBLE 17 way Keyboard Connector £3

28pin DIL HEADER PLUG

SOLDER type **£1.50**; IDC CRIMP type **£1.95**

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Increase the speed of your Disc Drives by soldering this switch to your BBC B or B+ Keyboard.

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to 3 pin DIN Plug + 1 Jack Plug	£2.00
to 7 pin DIN Plug	£2.50
to 3 Jack Plugs	£2.00
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Supply from BBC power supply to standard Disc Drive connector.

Single **£3.00** Dual **£3.75**

DISC DRIVE INTERFACE LEADS

BBC to Disc Drives Ribbon Cable

Single **£4** Twin **£6**

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RS423 (5 pin Domino)	40p	50p
Cassette (7 pin DIN)	25p	65p
ECONET (5 pin DIN)	20p	30p
Paddles (15 pin 'D')	80p	200p
Disc Drive Plug 4 way	75p	–
6 way Power Connector	80p	95p

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Computer Distribution Company, Parklaan, 47, 8-9300 Aalst, Belgium.

E.B.N., Elisenstrasse 13, 1000 Berlin 41. Tel: (030) 7952057

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*Velobyte, Scheaedyksadyk 5a-6a, 3011 EB Rotterdam, Holland, Tel: (010) 413 8197/414 5171.

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Z88 ONLY £239

FREE With every Z88 purchased from us this month, we are giving away absolutely FREE, a Z88 to BBC Interface Link, 4 rechargeable batteries and a compact Mains Battery Charger worth £38.

Z88 is a complete Personal Computing System

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The Z88 is much more than a stand-alone personal computer. It's the core of a comprehensive computing *system*, that allows you to take full advantage of the computer's remarkable potential. Accessories and peripherals include:

RAM Packs Up to three RAM packs can be plugged into the front of the Z88. They require no external power, and are available with 32K and 128K capacity. 1 Mbyte RAM packs will be available in the first quarter of 1988.

32K £17.35 128K £43.40

EPROM Packs Erasable Programmable Read Only Memory packs are the Z88's archiving medium, and are available in 32K and 128K. Whereas other machines have to rely on cassettes, diskettes or hard disks, EPROMs offer *solid-state* storage with very rapid access to data and absolute reliability. 1 Mbyte packs will be available in the first quarter of 1988.

32K £17.35 128K £43.40

EPROM Eraser When a data file has been saved onto an EPROM pack, it stays there until you decide to erase all the data on it. At that point, simply insert the pack into the EPROM Eraser, which completely deletes the data – leaving you with a blank EPROM pack, ready for re-use.

£34.75

PCLINK A package consisting of software diskette and RS232 serial cable. PCLINK allows the transfer and receipt of files between the Z88, and an IBM or compatible PC. As well as standard ASCII files, it converts Pipedream files into either Wordstar or Lotus files.

£21.70

Z88-BBC LINK connects the Z88 to the BBC Micro for file transfer purposes. Pipedream is compatible with View Professional.

£21.70

Serial Printer Cable connects the Z88 to any printer with a standard serial port.

£8.65

Parallel Printer Cable connects the Z88 to any printer with a standard parallel port.

£24.00

Modem BABT-approved, 300 baud, line-driven, full duplex unit that allows the Z88 to talk to other computers via telephone lines.

£86.90

Mains Adapter helps preserve battery life, and is useful when the Z88 is in constant use in a fixed position.

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PRODUCT CODE NUMBERS

PROGRAM TITLE	BBC B/B+	MSTR 128	COMPACT	ELECTRON
Global View	DB01	DB16	DB33	DE06
Graphics Pack 1	DB03	DB17	DB37	DE01
Musician	DB06			
Mode 7 Utilities	DB12			
Adventurescape III	DB20	DB28	DB35	
Combat Zone	DB21	DB30	DB32	
Easy Font	DB26	DB39	DB44	
ADFS Menu		DB27	DB31	
Graphics pack 2	DB29	DB34	DB38	DE29
Colour Ikon	DB36			
A&B Bibliography	DB40	DB53		
Bibliography Upgrade	DB55	DB54		
Statistics	DB41	DB42	DB43	
Home Office	DB46		DE46	
Graphics Constr. Set	DB49	DB50	DB51	
Master Only		DB56	DB57	
Getting Into Assembler	DB61	DB62	DB63	
Wordwise Plus	DB64	DB65	DB66	
Sideways RAM	DB67	DB68	DB69	
Pascal	DB70	DB71	DB72	
Adventure Special	DB73	DB74	DB75	
Graphics Special	DB76	DB77	DB78	
Skywatcher	DB79	DB80	DB81	
Online!	DB82			
Disk User One	DU1			
Disk User Three	DU3			

AVAILABILITY AND PRICE

ALL SOFTWARE AVAILABLE ON 80 TRACK (ADFS LARGE) FORMAT. ADFS OWNERS ENQUIRE FOR 40 TRACK AVAILABILITY.

Name	Product	Price
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ADFS	DB16	£10.00
Graphics Pack 1	DB03	£10.00
ADFS	DB17	£10.00
Musician	DB06	£8.00
Mode 7 Utilities	DB12	£8.00
Adventurescape III	DB20	£15.00
ADFS	DB28	£15.00
Combat Zone	DB21	£8.00
ADFS	DB30	£8.00
Easy Font	DB26	£10.00
ADFS	DB39	£10.00
ADFS Menu	DB27	£12.00
Graphics pack 2	DB29	£10.00
ADFS	DB34	£10.00
Colour Ikon	DB36	£8.00
A&B Bibliography	DB40	£15.00
ADFS	DB53	£15.00
Statistics	DB41	£10.00
ADFS	DB42	£10.00
Home Office	DB46	£10.00
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Mark Webb

Computer graphics and medicine come together to create a new and unique package for the BBC Micro.

Realism and entertainment both have a part to play in the success of Electronic Studio's range of interactive software

A PICTURE OF HEALTH

For those outside the medical industry it is difficult to understand why a group of general practitioners should reserve a place in their diaries for a visit by a BBC Micro or why leading consultants should risk their reputations by playing a computer game.

Both are frequent and perfectly normal events since Jeannie Hughes of *Electronic Studio* spotted the potential of interactive computer software to communicate in a convincing fashion with the medical profession.

It all started with a BBC Micro and a simple question and answer system to promote a particular drug. Jennie Hughes' journalistic background encouraged her to be more ambitious with the "scripts" and to experiment with computer graphics. She set up Electronic Studio to create the software and began looking for a computer artist.

After two years of searching and a little help from Acorn, Jeannie Hughes finallly found and started working with Cambridge-based computer artist Abbas. Abbas had to learn about the medical background because realism, as well as impact, was all important.

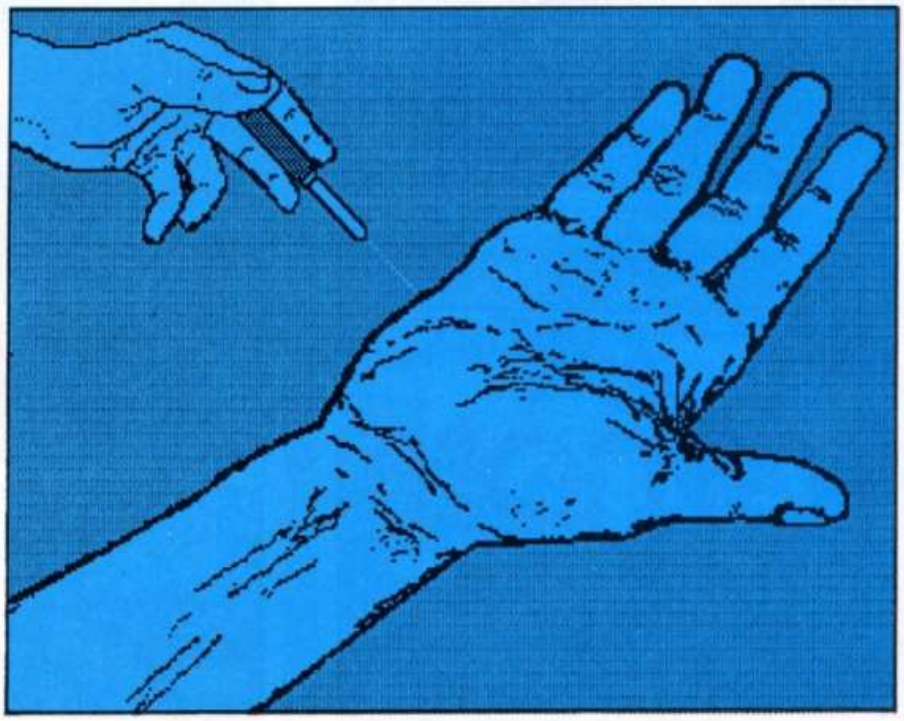
Screen representation

Electronic Studio supplies interactive computer software to support drug companies in their marketing of new drugs and treatments. Representatives of the companies go out into the field and make presentations. They carry their BBC Micros in the back of the car.

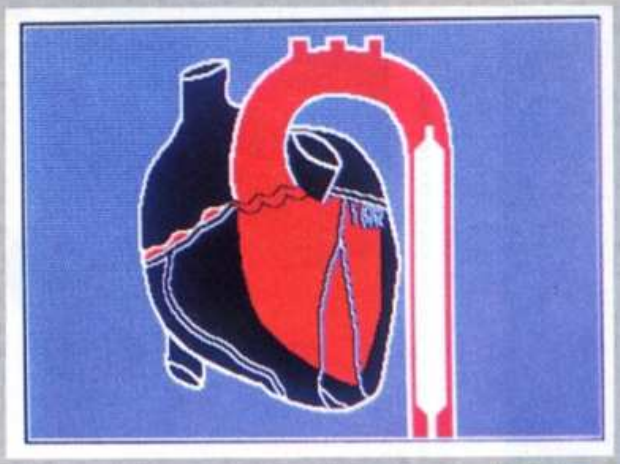
Each project is put together with the help of a "super-consultant" acting as an advisor. The consultant's views are interpreted through the script into the computer program. A recent program on heart transplant was advised by the Jacoub team at Harefield hospital. Because the transplant itself is now considered simple, the software concentrated on aftercare. Pharmacists are now involved and there are programs on practice management for GPs. A further prospect is software suitable for medical students.

Getting involved

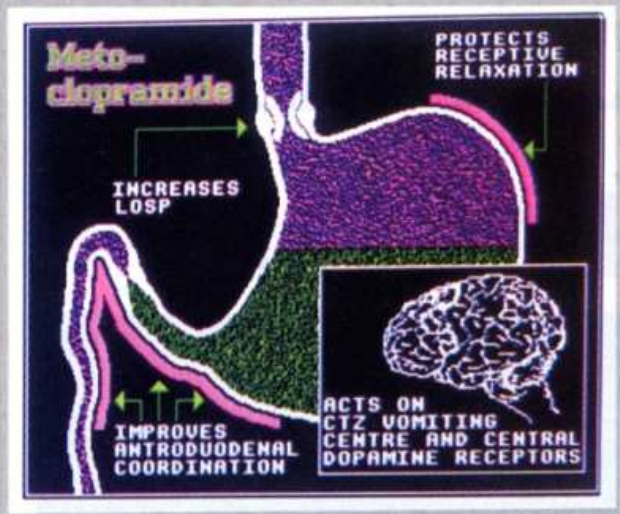
Unlike other media, the computer can respond to different reactions from its audience, can follow a particular course of action and retreat to try again. This investigational "what if" aspect helps get a, perhaps

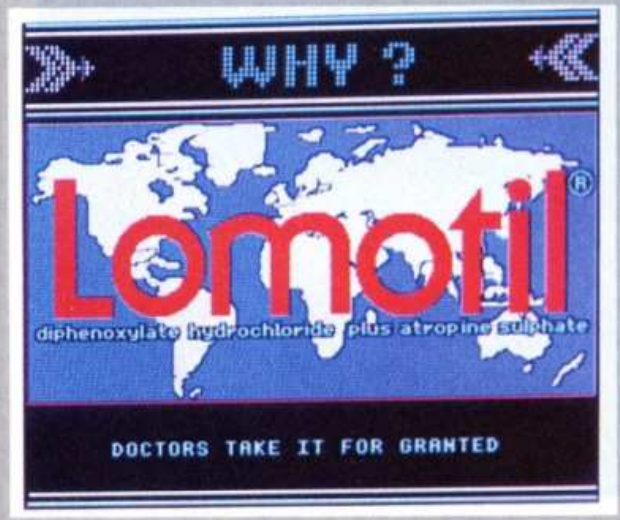


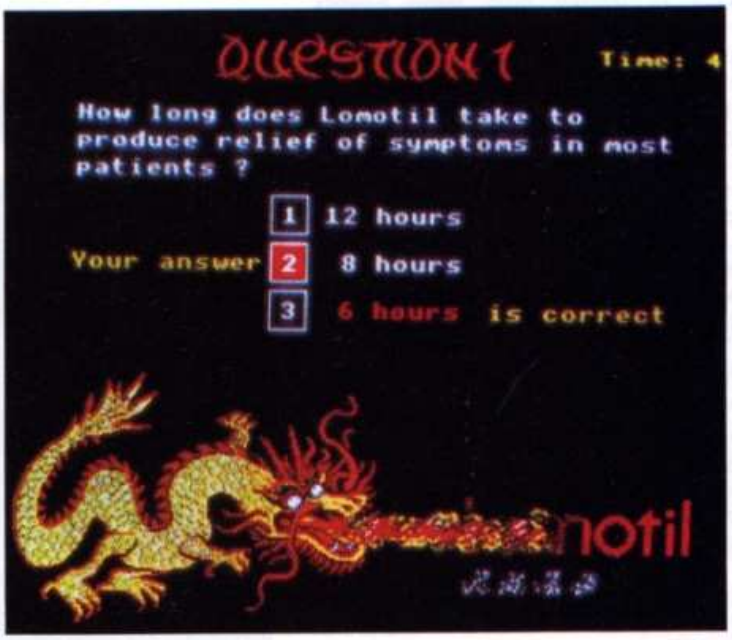
A&B Anatomises computer graphics at The Electronic Studio



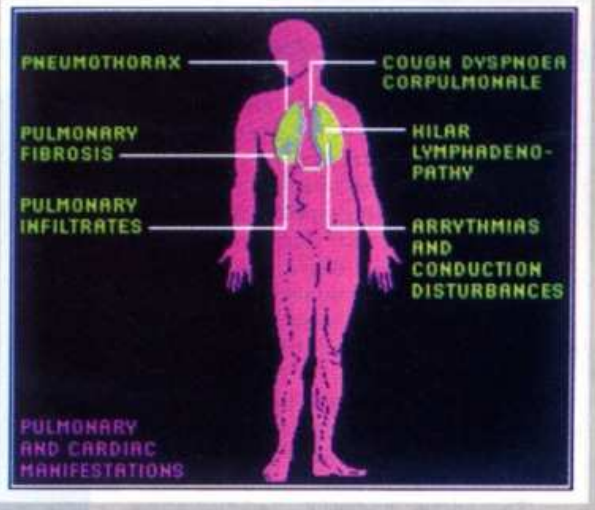
The standard radiograph of the knee includes anterior-posterior (weight-bearing or non weight bearing) plus lateral 30 degree flexion views.



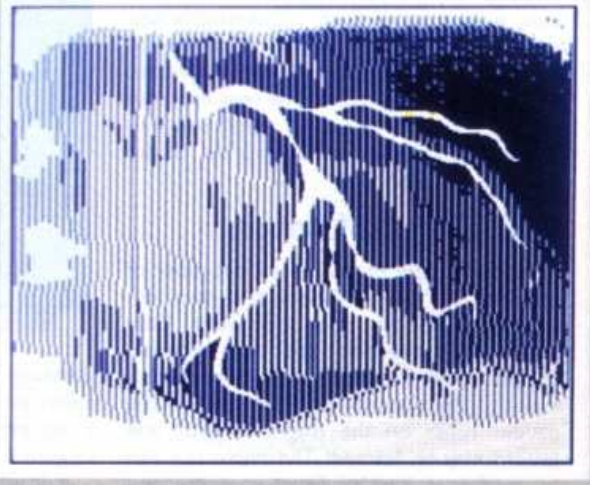


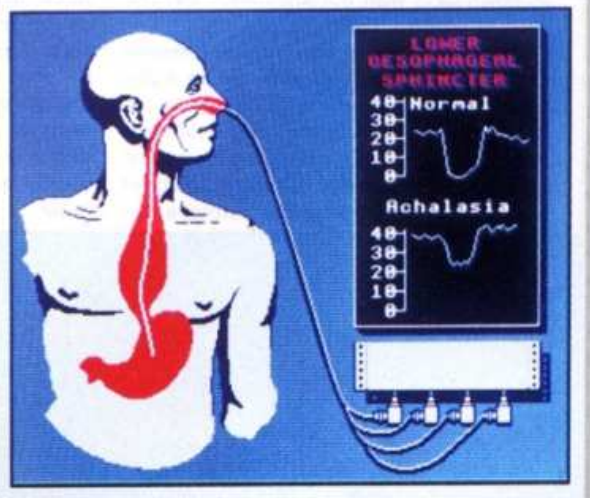

QUESTION 1
Time: 4
How long does Lomotil take to produce relief of symptoms in most patients ?
1 12 hours
Your answer 2 8 hours
3 6 hours is correct
motil

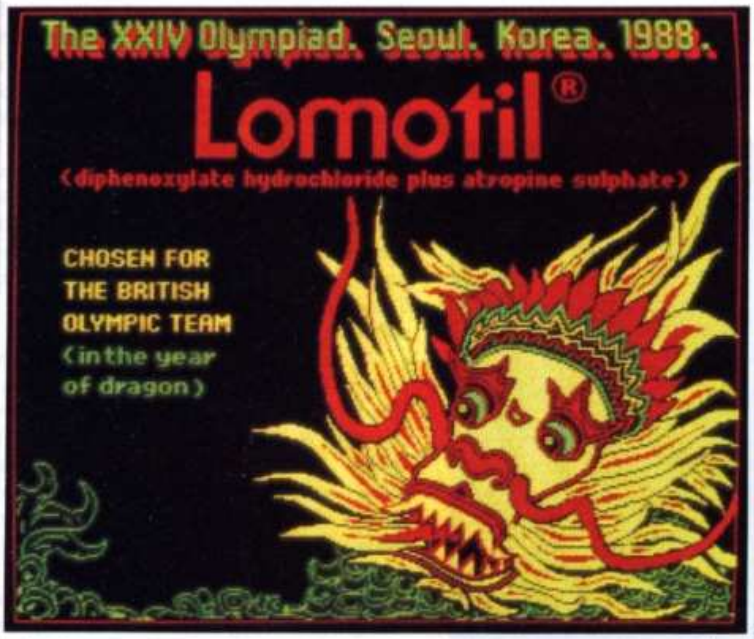
The Electronic Studio has been using the BBC and Master computers for several years to produce sophisticated graphics and programs to introduce new drugs from well-known pharmaceutical companies and to demonstrate surgical and other medical procedures. The BBC-based Prisma II has on occasion been used to boost the graphics. The Electronic Studio is now expanding into the veterinary market and the use of IBM compatibles.



Computer graphics by Abbas.






The XXIV Olympiad. Seoul. Korea. 1988.
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CHOSEN FOR THE BRITISH OLYMPIC TEAM
(in the year of dragon)

sceptical, audience involved. Doctors begin questioning both a drug's qualities and their own methods of treatment.

The programs can't be too long-winded and they have to be consistent in operation so that the rep can learn quickly. The programs are colour coded (green, yellow, red) in the way they respond to input. Reps have been known to become "stagestruck" and turn into real showmen! Generally the programs are seen as a way of building rapport. There were doubters but, as often happens, they have turned out to be some of the most enthusiastic users. And the statistics show that sales improve.

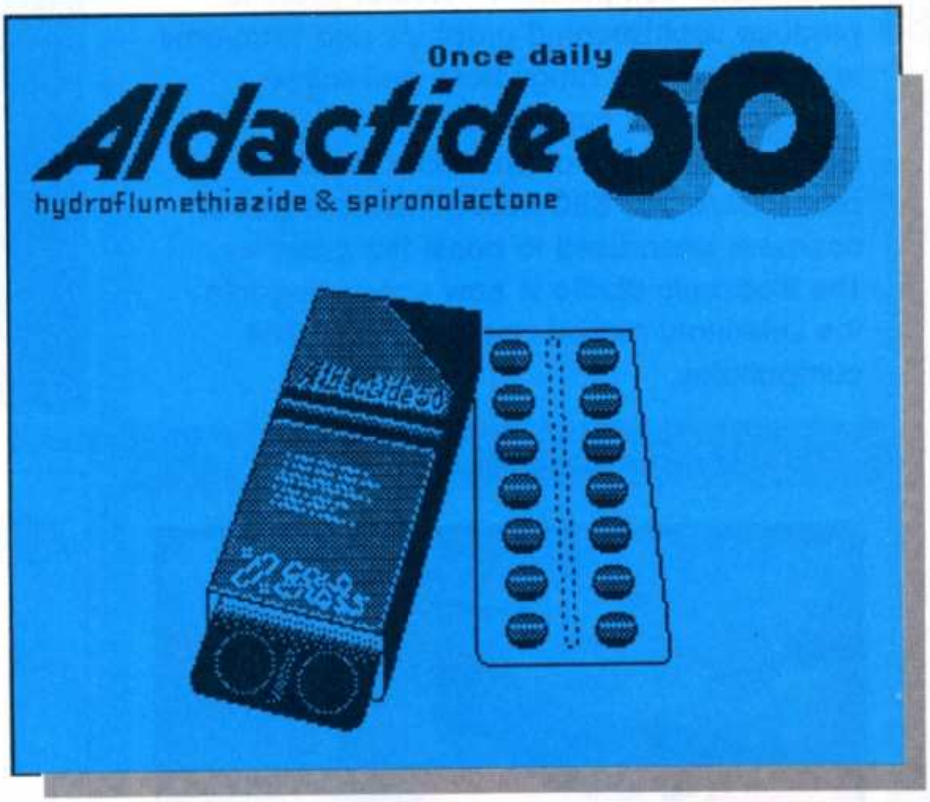
The drug company representatives, through taking part in discussion with doctors, get to know their requirements and preferences. It results in important market research on competitors, newly launched drugs and patient profiles. The reps may well identify a gap in the market. Responses are electronically logged in some cases as the program is in use.

Coming to blows

Electronic studio have pursued a number of scenarios in their software and have developed a feel for what will work. Case studies by computer are very popular. Symptoms are presented and a chronological investigation undertaken. The fate of the patient relies on the diagnosis given and lessons may be learned! The micro can also be used as a kind of flip-chart presenting unknown facts with documentation and diagrams to support them.

When dealing with the medical profession certain ethical standards have to be maintained. This presents little problem to Electronic Studio because their software deliberately leans away from the promotional towards the educational. There is plenty of evidence of the interest this software can generate. Two consultants almost came to blows over their different interpretations of a case and doctors are regularly late back for surgeries!

Editorial judgement is required of course when dealing with particularly harrowing treatments, such as a bone marrow transplant. The computer program has to reflect the drug company's desire to help people in this situation. A more common treatment such as renal transplant can be given a different edge and a stomach disorder on holiday in sunny climes can result in a flippant game.



THE PHALEN MANOEUVRE

New audience

Urged on by her clients, Jeannie Hughes has created more demanding scripts, has stretched the BBC Micro and inspired Abbas to respond with ever more realistic graphics and animations.

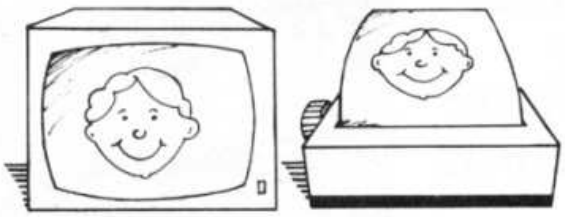
Over the years other computer systems have been investigated with varying success, Apricots, Pluto Graphics and lately, the IBM compatibles. The Archimedes seems the ideal machine to move medical graphics into the next dimension but price is a stumbling block. Meanwhile the BBC Micro software continues to be successful.

A particulary interesting development is the commissioning of software from Electronic Studio with patients as the intended audience. The doctor is given the software to run in his or her surgery or health centre. Schools might benefit from this kind of software too.

A recent program on diabetes sends the patient out shopping, advising on the suitability of purchases related to diet. In fact the program is based on a board game by the British Diabetic Association. The arcade game and quiz elements are at their strongest in this situation as you would expect. Better than old copies of Country Life any day!

Electronic Studio, Jeannie Hughes and Abbas can be congratulated on devising some of the most visually interesting software ever written for the BBC Micro. Computers are widespread in medicine and the technical displays have to relate to real-life. But there's excitement too as a recent drug company production relating to the Olympics demonstrates. When you are next in your doctor's waiting room, look around to see if he's providing the right sort of entertainment.

SCREENPRINT



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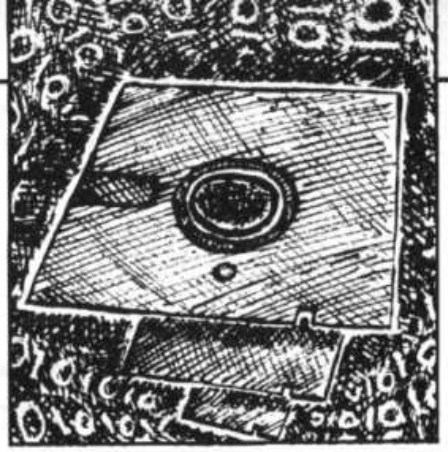


The Realtime Solids Modeller from Silicon Visions has been vastly expanded

SILICON VISIONS

The *Realtime Graphics System* from Silicon Vision showed many people just what the BBC micro was capable of when it came to high speed graphics processing. Few believed that Elite-style graphics were possible outside the realms of a machine-code game, certainly not under the control of a generalised graphics package.

Rather than rest on their laurels, Silicon Vision have now augmented their package with further additions to give it the ability to cope with shaded solids – just as Elite has been "upgraded" to display "solid" spacecrafts.

This new (and latest) package is compatible with all BBC micros and the Master 128 – it is supplied either as an upgrade for existing Realtime Graphics System owners (for £39.95) or as a complete package for £89.95.

Now you may think that the price seems like a lot of money for "just another drawing package", but the Realtime Solids Modeller is a complete solid model design system allowing complex solids to be "built" in your Beeb and then displayed from any viewpoint, (either statically or animated) and you can even simulate motion.

Full 3D perspective manipulation of coordinates is provided along with hidden line removal. This is really an amazing feat – just working out the maths of it all is hard enough. To fit a program to do it all into a sideways ROM inside a BBC micro is near miraculous.

The Realtime Solids Modeller is provided on a 32K ROM on a small carrier board to fit into any single ROM socket. The system also comes with six disks providing examples models, a demonstration program and the design suite.

The ROM contains just a suite of routines to manipulate 3D co-ordinates and to plot the results very quickly on the screen. This is the really clever bit, but it is the part that attracts the least attention. What takes up most of a user's time is the model designer program (supplied as a program on one of the RGL's disks).

Graphically Speaking

Let's say that we want to produce an animated "film" of a BBC micro whizzing around the screen (and why not?). For the sake of sanity we will only use a very simple shape of a model B – just an outline – although RGL is quite capable of coping with the keyboard, speaker grille and other such details.

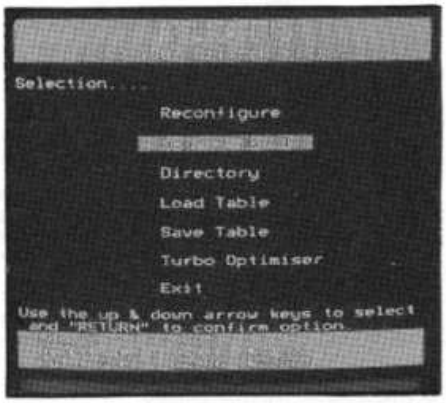
The first thing is to switch off your Beeb and reach for the pen and paper. Yes, (shock, horror!) the Realtime Solids Modeller cannot help with the initial design process. Actually turning your minds vision into a list of 3D co-ordinates is not easy and a bit of graph paper is very useful here.

However, the RSM has a few tricks up its sleeve; to define the BBC Micro model only one side need be plotted out on paper. After a few measurements of the real thing, this is quite easily done.

Now the model designer is started up and the co-ordinates of one side are entered into memory. This is done with a sort of "co-ordinate processor" much like a word processor but, quite naturally, for coordinates. Each co-ordinate is entered as an x, y or z value along with information stipulating whether it is a line to drawn to that point or just as a *move* statement. The colour and type of lines used (dotted or solid) are also entered.

In addition to the original RGL ROM is an extra entry to tell the system that the following points make up one face of a solid object. This is given a colour too, so the faces can be coloured differently to their outlines.

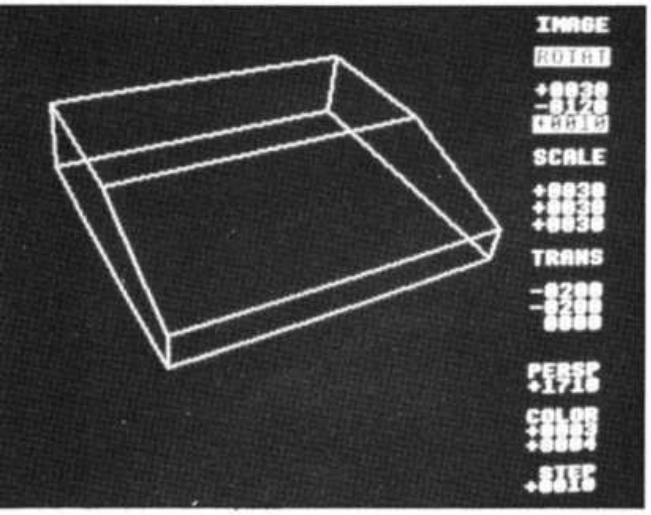
Now the co-ordinates can be entered, altered, listed and saved to disk. They can't be copied or block moved which is a bit of a shame, and this is something Silicon Visions should think about for future releases, but still, the advantages of this system far outweigh the disadvantages of having to hand code all of the routines!

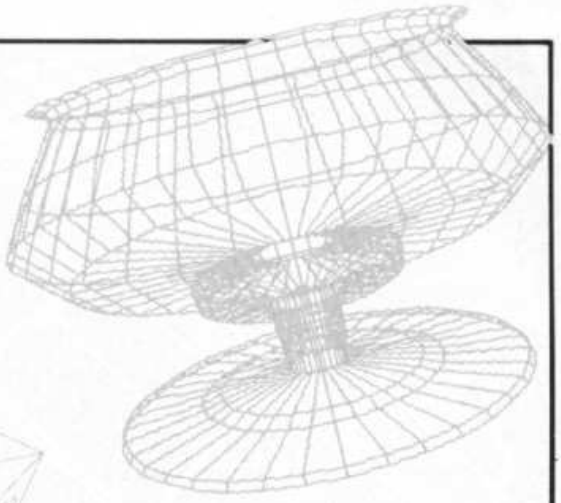


Now the clever bit; the one side of the model Beeb can be "extruded" into a whole Beeb by the software. It will translate the co-ordinates by a specified amount and join up the resulting new side to the old one. This saves a lot of work.

VECT COMD TYPE COLOUR X , Y , Z
0001 Facet grey
0002 Move 0 0 +16
0003 Draw Sld red 0 +3 +16
0004 Draw Sld red +13 +6 +16
0005 Draw Sld red +26 +6 +16
0006 Draw Sld red +26 0 +16
0007 Draw Sld red 0 0< +16>
f0 - Append f2 - Insert 0007
f4 - Delete f6 - Jump
To exit press the TAB key.

Objects can be rotated about the origin to form *solids of rotation*. For example, a simple rectangle can be rotated to form a disc. This makes the difficult and tedious task of entering the data much simpler, than say, having to enter data over and over again.





Complex ties and links

Complex objects can be built up of simpler ones too. A *macro* facility allows you to add a building block to another after rotating, translating or scaling it, therefore simple cube and pyramid building blocks become almost all you need to create really complex shapes.

Once these shapes have been built up, the model can now be viewed. The model designer includes a section to give a perspective projection of any model (or any part of an unfinished model) from any angle and from any distance. The views can either be from MODE 4 or MODE 5 screen (if you want to see it in colour). The *designer program* itself takes up too much room to allow mode 0 or mode 2 at this stage, although you can, of course use these modes.

The *viewing program* alone goes further than many such packages do and thanks to all the clever 3D projection routines inside the ROM the whole process is remarkably fast.

The models can be viewed in a number of different ways. You can inspect either a wire frame representation or a "solid" view with hidden line removal. Here is where things get a little complicated.

Presented with eight points joined together the RSM doesn't know if you mean it to be a solid cube or an open box or a square section tube, so defining the right number of faces in the first place helps, but there are other more complicated rules to adhere to.

The RSM manual tells you that the face of a solid will be seen and opaque when it is viewed from the side with the coordinates defined in a clockwise direction. This means that you have to think things through very carefully when you are entering your co-ordinates in the first place.

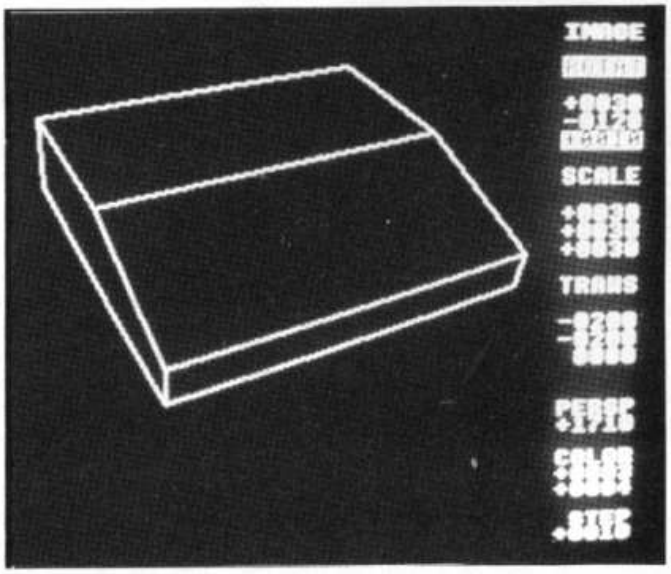
There are also three ways the RSM can display a solid. Totally convex solids which enclose a centre part with no "windows" are easy enough. However, concave solids pose more problems. If a slide face is seen through a window then the clockwise rule means it will become (appear) transparent. So the viewing program allows two modes, one of which accounts for this.

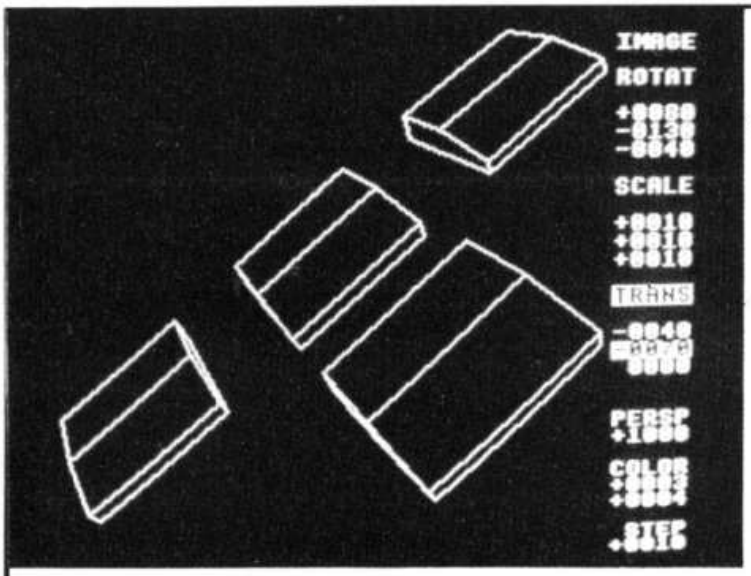
To make sure really complicated shapes come out properly (or at least in the way you anticipated), the RSM includes a "processing" program to sort out all the faces so it knows what goes where, this takes and inordinate amount of time to complete and the process can be undone. However, it does make life much a bit easier.

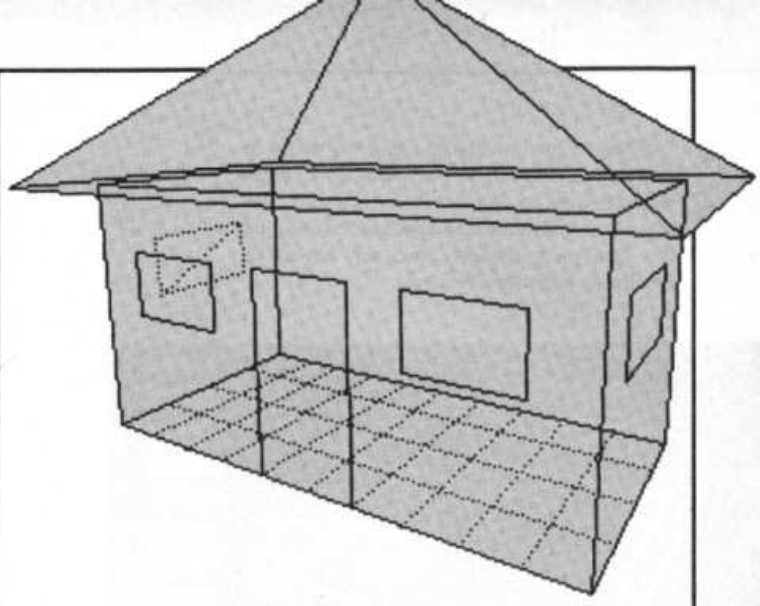
All this juggling with the rules of geometry is very complex and not that well explained in the manual. However, after struggling with a rapidly disappearing cube for a while I finally got the hang of it all.

When you have managed to create the model you want and have inspected it from all the desired angles, more pleasant views can be stored for future adoration. Two methods are provided. The screen image can be simply dumped to disk for inclusion in a slide show or, for later dumping to a printer.

Alternatively, the plot codes used to draw that view of the model can be saved. This has several advantages; the plotter files can be used to recreate the view in any screen mode and on machines without the RSM ROM.



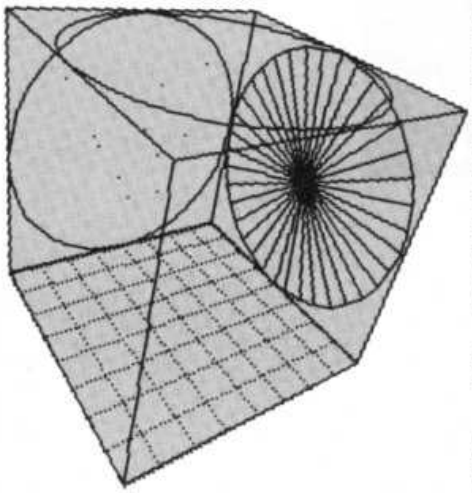


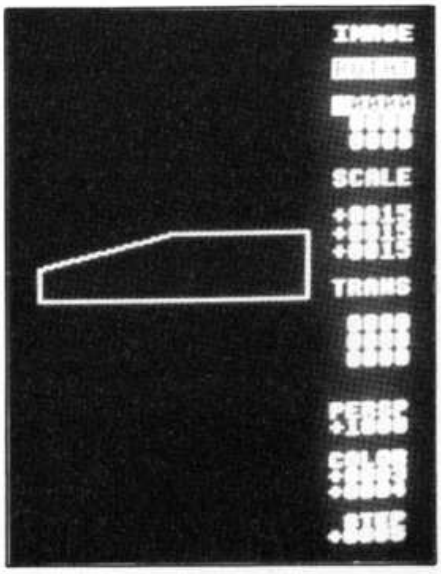


These *plotfiles* also take up less room on disc than screen dumps but more importantly, they can be used to drive a plotter such as the Linear Graphics *Plotmate* range of plotters. The resolution of the viewing screen makes direct professional use of the system impossible however, treating the screen output as just a rough guide, the system can be used to produce plotter data at truly useful CAD resolutions.

All this is quite enough for most packages but with the RSM ROM the fun has only just begun. Our task was to animate our Beeb models and this is where the Realtime Solids Modeller really proves its worth.

First, the data for the model is converted to a condensed form inside the designer and





then you can work on it, with help from the ROM, from BASIC.

All the ROM routines used for the designer program (and a good many more) are available to the user as * commands. Commands are available to make the calculations and plots the chosen views. All the relevant parameters about the viewpoint, scaling and perspective of the view you want are held in Basic variables with memorable names such as **xscl%, yrot%** and **ztrn%**.

SILICON VISION
SILICON VISION
SILICON VISION

ROM directly uses the values held by these names variables. This makes passing the values between the BASIC controller program and the machine code workhorse extremely easy.

For speed freaks writing programs in machine code, parameters are passed in a parameter block (an extremely large one!)

Of course, speed is all important for animation, and the RSM has several means by which it can provide much faster animation than can normally be achieved. First, model data can be "optimised" – sorted out and crunched to remove repeated co-ordinates, so that the plotting routines aren't continually moving about the model unnecessarily.

The ROM's own plotting routines are used – these are far faster than the Beeb's usual ones, it also includes a double screen RAM system to allow each frame of an animation to be drawn invisibly whilst another view is displayed and then the two swapped. This is very nicely implemented with all the mechanics available to the user if its wanted or all taken care of automatically if needs be.

Frantic Action

Of course, *two* lots of screen RAM means that only MODE 4 and 5 can be used with this technique on a normal Model B micro. The net result of all this work is quite dazzling animation created with simple BASIC programming. When the screen gets crowded with more than three simple models (or just one complicated one), then the speed inevitably suffers. However, for animating relatively simple shapes (such as Elite-type spacecraft) in real time or complex ones in a single frame manner, the system is superb.

Mastering all the * commands and the essential BASIC programming skills required by the system is not immediately easy.

The manuals could be considerably improved. The main problem is that the RSM system is provided with the original Realtime Graphics System manual along with another to explain all the differences. This is a good idea if you are meeting the system as an update of the old one, but if this is your first encounter with Silicon Vision's package, then it does get rather confusing.

However, 23 example programs are given on disc and these provide an excellent basis for experimentation; I found the easiest way to write applications was to start with one of these programs and slowly adapt it more and more until I had what I wanted happening in front of my eyes.

The Realtime Solids Modeller will never help you to write your own Elite. It cannot cope fast enough with all the moving objects at once as it is a generalised system.

This software is exceptionally useful in the maths classroom as there is a great deal of information regarding geometry and perspective to be learned, and it is a great way to spend an informative half hour in front of the micro!

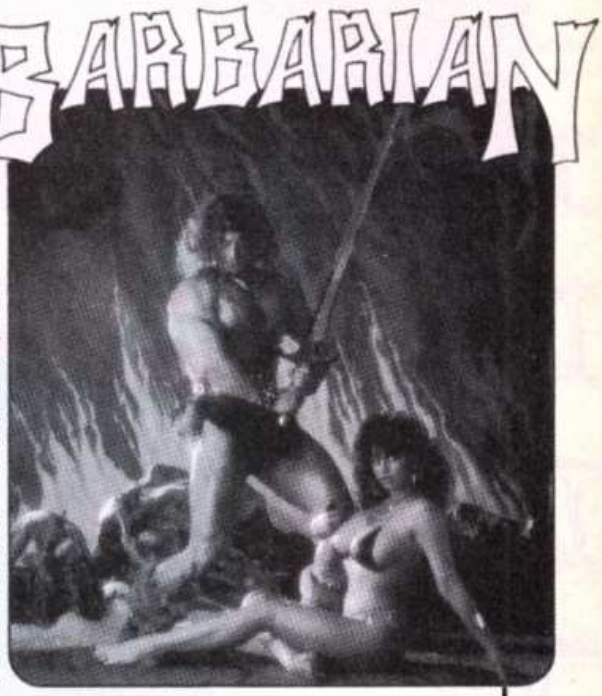
Whatever it is used for, the Realtime Solids Modeller is in a league of its own.

Factfile

● **The Realtime Solids Modeller is available from Silicon Visions at 47 Dudley Gardens, Harrow, Middlesex HA20DQ. ☎ 01 422 2274**

Dave Reeder

So where are the new games? What's going on here? Would you believe it, but fun, as usual?



Welcome!

Another month where software houses obviously expect us to look after ourselves and return again and again to our collections. In short – nobody's releasing goodies for us.

This month's major release may well be overshadowed by controversy about the packaging but those of us with our ears to the ground are confident of good times to come.

Meanwhile, it's an interesting challenge to wonder how soon it is before Archie games outnumber Beeb games. Any takers for the sweepstake? I reckon January next year – what do you think?

controversy in the computer press about the advertising and packaging for this game (and now *Vixen* as well! See last month's Back Page for the hot poop) – shock horror time. Innocent young games players exposed to the ample charms of Ms Whittaker – isn't it dreadful? Even our esteemed companion on the newstands Acorn User has banned the advertising, apparently.

What a lot of fuss about nothing! Apart from the self-evident truth that Superior are merely using the original Palace advertising and packaging, it's all a bit hysterical. So, there's a girl with not many clothes on. So what? Are you all so starved of such sights that you'll rush out and buy the game –

THE ARCADE

Game of the month

Barbarian
Superior Software/Acornsoft Model B/Master/Compact/Electron Tape/disc £9.95/£11.95/£14.95
Graphics/sound 8 Playability 8 Originality 7
Options 2 player Value for money 8 Lifespan 7
Overall 8

My, it's been a couple of busy months for programmer *Dylan*, hasn't it? Firstly, last month's comedy arcade adventure *Spycat*, this month the savagery of *Barbarian* and yet another mystery conversion coming from Superior soon. As you'd expect, The Arcade has a good tip on the identity of this mystery man – the usual fiver will keep my mouth shut!

Now I could understand these rush releases from Superior if the "Dylan" games were outstanding, but I find them only competent – the mystery, for me, is what is happening up there in Superior. Game after game has been talked up to the press, from last autumn onwards, but all we get to see is other stuff apparently jumping the queue. Must mean something.

Anyway – this month it's sword and sorcery time. Conan the Barbarian – lots of gore – half-naked men with broadswords flashing (and matching steroid problems – Ed). Half-naked men? Excuse me – the noticeable thing about this game is the packaging with half-naked Page 3 model Maria Whittaker revealing the prize(s) for the victor.

Cor, what a sizzler, eh fellas? No, not really (*ere, what about the mamalian protuberences? oops sorry, let's get out of crass mode – Ed*). You must be aware of the wouldn't it be cheaper to buy the Sun or the Star? No, what is sickening is the hypocrisy that equates a girl in a bikini with "the end of civilisation as we know it" and ignores the the violence in the game – far more worrying in that the aim is to chop your opponents head off!

Of course, it's easy in all of this to forget the game itself. As a C64 conversion it's competent – resembling *Way of the Exploding Fist* in many ways. Given that you practice your deadly moves, you're faced in the game itself with an opponent (friend or computer) armed, as are you, with a sword. In a reasonably sized window on screen you have to chop hell out of him, whilst avoiding his deadly cuts and thrusts. That's it – nothing astounding, nothing exceptionally bad.

The gameplay is okay – attacking and blocking moves are quite well animated but a defensive roll across the screen looks really dumb and when both fighters are in close then their legs do a kind of demented dance – not very convincing for such macho brutes. As is usual in these games, there's a choice of about 16 moves depending on whether you press the fire button when directing the joystick – head butts, defensive blocks, moving forward, etc etc.

There are some nice touches – a mini monster appears at the end of each combat to drag off the vanquished barbarian and, if the hype is true, at the end of the game there is a touching reunion with your beloved – the afore-mentioned semi-nude.

At the end of the day, it's alright. I can't get any more excited than that but, in the welter of publicity about naked flesh, I suspect my words will fall on stony ground. A shame – it's all a distraction from the game and is bound to alienate girls from computer keyboards even more. It's perfectly possible to write about or illustrate the sword and sorcery genre without the obligatory bimbo – can I point you in the direction of the excellent Kane stories by my sometime drinking pal Karl Edward Wagner? Assuming that the market is composed solely of adolescent males does nobody any favours – least of all Maria Whittaker.

(*Dave, Kane is also a "spanking" mag on restricted sale in some of the less seedy shops in Soho, not that we read it mind! – Ed*)

Anarchy Zone

Atlantis Software Model B/Electron Tape £1.99
Graphics/sound 7 Playability 8 Originality 7
Options sound Value for money 8 Lifespan 6
Overall 7

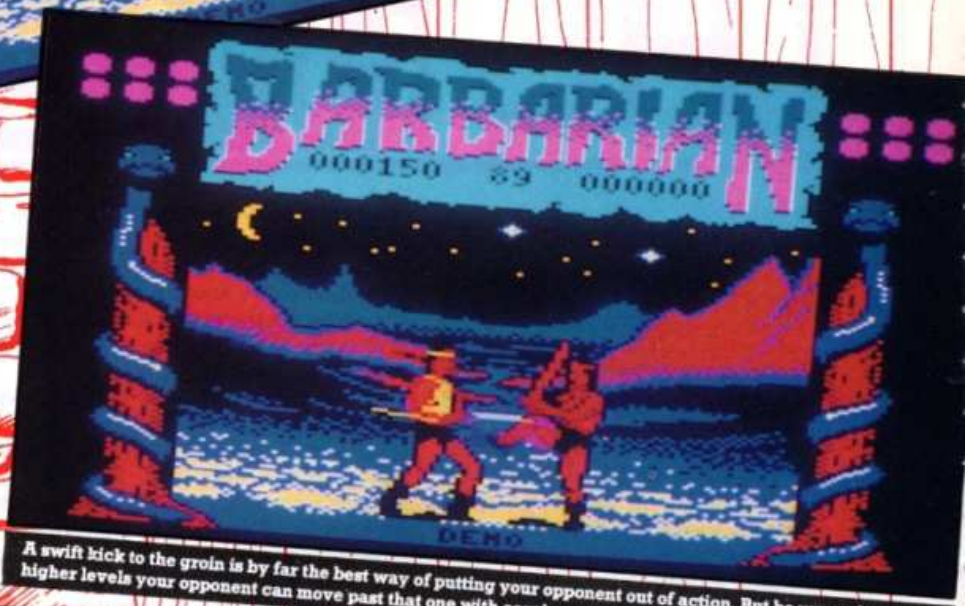
The most surprising gems are emerging on budget labels these days. Take, as an example, this shoot 'em up by Rob Dulstone – a very competent, very enjoyable space romp that is worth more than its pocket-money price.

The aim (as always) is to shoot hell out of everything but what distinguishes this game from a thousand others is a small twist – instead of shooting from just the bottom of the screen, you can circle all around the outside of the screen, thus shooting aliens in their annoying patterns from the most advantageous spot.

In that, it's unusual. Nothing much else is too original – the graphics are pretty nice, the alien patterns are diverting, the level of gameplay just enough to get you to return. In short, it's a very nice game that, somehow,

arcade alley

Two Thugs with a steroid problem bash it out – but can it be simply over the Priceless Maria's baubles? (or whatever)

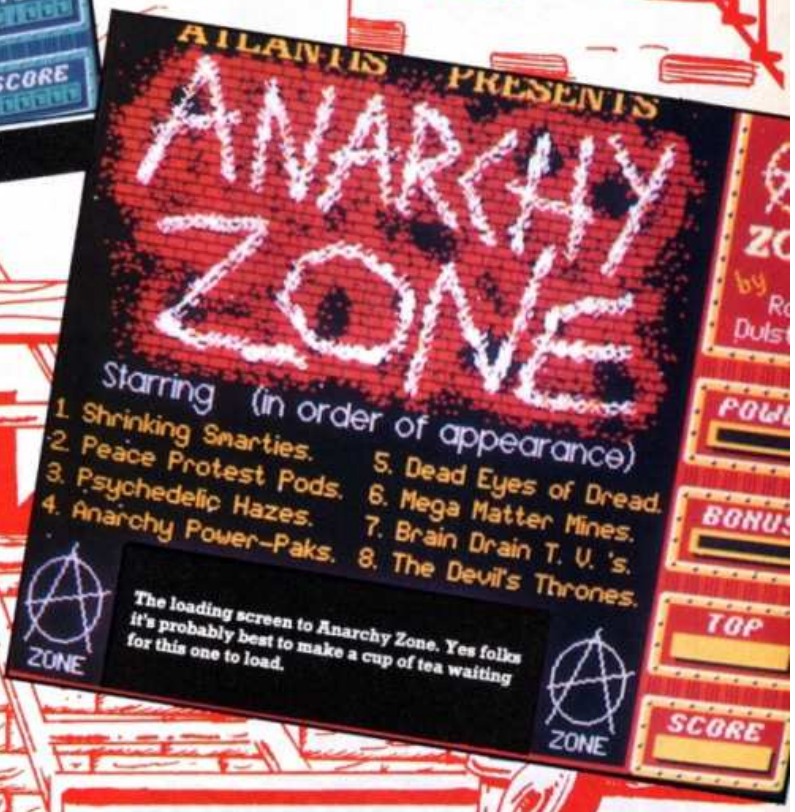


A swift kick to the groin is by far the best way of putting your opponent out of action. But be warned, at higher levels your opponent can move past that one with ease!

Vanquished at last! The winner is obviously brandishing his mighty vorpal – but still no Maria boys.

COUNCIL NOTICE... SHAPE UP OR ELSE

Anarchy Zone – smooth formations of aliens, a novel approach to positioning your fighter, and a lot of action.



The loading screen to Anarchy Zone. Yes folks it's probably best to make a cup of tea waiting for this one to load.

All will be revealed – soon. The RepoBall diary is soon to come to an end – and with it, its imminent release!

just misses the final buzz of excitement that would make it a classic.

However, for the price, you'd be very dumb not to pick up a copy and enjoy it for a few evenings.

*LOADing soon

The recent Micro User Show in London was like a desert – for games players, that is. The only software house in evidence was Tynesoft – are we really now condemned to future shows of cheap printer paper and endless Archie add-ons? Admittedly, the Impact Games Club guys were there, rapidly enlarging their 5,500 user base, talking up the forthcoming Mark Gidley cheat disc *Cheat it again, Doc* and generally exciting game-starved attendees.

On the rest of the software front, where are the scoops? Well, which would you like first – news of the next Tynesoft sports simulation or news of the next major license from Tynesoft, following *Spy Vs Spy* and *Boulderdash?*

I thought so. Coming for the autumn across who knows how many formats will be *Superman* – the first of a potential series, not necessarily tied to any particular film. It sounds good and, if you're planning on being at the PCW Show, you can expect to see a playable demo there.

The game is to be coded on the Beeb by the busy Kevin Blake, after he finishes *Summer Olympiad* – the next sports-whammo with simulations of triple jump, fencing, high diving, high hurdles, skeet shooting and a "mega" opening ceremony promised.

Final Tynesoft titbit – congratulations to software manager Dave Croft (apologies, Dave, for calling you Crofts at times), soon to be married to Hilary Allsop. Guess where the romance-mad Croft is taking his bride for the honeymoon – the Seoul Olympics, of course. Anything for a cheap publicity tie-in, these Tyneside lads!

On to other friends – the street-cred kids at Go-dax. Many of you were intrigued some issues back by screen shots of a game called *Retrogue* – now the game is coming. Sadly you'll have to buy another computer as there's not enough memory on the Beeb. What is due for an advance report next issue is the multi-player epic *Bolo* – watch this space.

Also due from Go-dax is an Archie game from Simon Heather, from a related company, Top Ten is a whole pile of goodies – Kevin Titcombe's *Khan the Swordmaster* in June, Nathan Williams' *Temple* and a revoltingly titled compilation *Bogie's Pick* (J.Richardson's *Kwantung*, Mal Evans' *Time Traveller* and two games by Mark Weatherill – *Gaxmen* and *Blasteroids*) in July, Carol Sharp's *Deadenders* in August and *Dojo Dan – Karate Man* by Charles Sharp in September.

Yet another new Archie game – *Hoverbod* from Minerva, the *Minotaur* people – out now.

Superior is busy again – watch out for *Repton Thru Time* with yet another 40 screens, *Pipeline* (reviewed here *months* ago) and this year's mega release *Exile*.

Mega Apocalypse due soon from Martech – advance word suggests a kind of sequel to *WAR*.

Did I mention that Mandarin are re-releasing that classic adventure trilogy *Time and Magik*? (see last month's news item – Ed)This is an enhanced version of the trilogy but wil require shadow and sideways RAM on the humble Beeb.

Just missing my deadline is the new, improved *Galaforce II* from Kevin Edwards – a full preview next month of the first Kevin Edwards game with a built-in cheat mod

Repoball Diary

Friday, 11 March. With my wrists and neck aching from rope burns, I returned to the keyboard. The game has been drawing out since Christmas so I reckon it's time I finished it once and for all. Today I got the ball animation going, the scroll velocities, the

TROCC 9
THE PENULTIMATE EPISODE
AHA! YOU'VE ARRIVED AT LAST!
OH SHUT UP...
R.I.P. Dave!...
AHA HA HA
AND WHAT ARE WE GOING TO DO WITH YOU?
PPPLEASE SIR..... I W-WANT TO GO H-HOME.
NEXT: THE LAST, BUT NOT LEAST...
T.Glover '88.

first Sat's moving and the bullets killing them off. I've been meaning to enter the new scroll routine into the game code for ages now so I'll get that done tomorrow.

Saturday, 12th March. Entered the new scroll code straight off the top of my head and it worked perfectly first time. Miracles will never cease. Anyway, this meant that for the first time, I saw all five sprites and the stars and the scrolling and the bullets with neither a judder or a flicker to be seen. This spurred me on to add a few extra refinements to the code and ended a good day.

Sunday, 13th March. The Saturnians are now on auto pilot and are circling round the moon. You have to do some pretty sharp manouvering to avoid getting caught inside their circle. Also, when you shoot them, they explode and a new wave attacks when they're all dead. Nothing new there, I admit, but it means that the controller is fully working.

Monday, 13th March. Worked on some of the finer parameters for the Sat's movements and collected all the sprites – there's about 36 Saturnian sprites, 6 Repoball sprites, 8 explosion sprites and a few miscellaneous ones. There's about 6K of background Graphics in there as well. A large chunk of the sprites and the background stuff has been compressed so this left a respectable amount for the program.

Tuesday, 14th March. Sound time. I want to get the FX in now so I've got time to play around with them as I finish the game. First one in was Repo's firing sound. This sounded like a damn machine gun instead of a...well, a Repo gun! A bit of flickering appeared, meaning that the sound'll have to be played at 50Hz as opposed to the standard 100Hz to reduce CPU overheads.

Wednesday, 15th March. Decided to redraw and replace some of the background graphics. This produced stuff that is a lot better. I'm having to draw large strutures to put the sprites into scale. This suits the compressor just fine.

Thursday, 16th March. More work on the moons and I assigned differrent landscape styles to different moons e.g. Mushroom, Bubble, Cactus...etc.

Friday, 17th March. Still mucking around with the sound. At last I got the sound right for Repo and not a hint of overrun. More Saturnian attack patterns.

Saturday, 18th March to Sunday, 19th March. Too busy with other things to work on the game.

Monday, 20th March. Put in the bouncing hoppers which look great! They met with approval all round. I tried to add a bouncing sound but, sadly, it didn't work with four boings one after another. I'll have to stop the sound being generated will one still going.

Tuesday, 21st March. Damn near electrocuted myself today. Knocked over a glass of Coke and the stuff got everywhere and splashed over the end of the ST power cable which I leave loose underneath the monitor plinth when I'm not using it. Lucky I pull the plug on it just in case. A lengthy cleaning up job and an early day.

Wednesday, 23rd March. Ran a few timing tests and it looks like I'm at the limit. No more raster time – everything's been pumped up to maximum speed at great memory cost but still I need just one more inch.

Thursday, 24th March. OK....so I'm a little lazy.

Friday, 25th March. I can't believe it! I can't get the inch anywhere. I'll be goddamned if I'm gonna come this far to be nailed by a lousy inch. Everything is in now except for the stars. The stars give the game a real feeling of depth and are basically an essential item.

Saturday, 26th March. The first of the new moons is in. This is great. It's like living in an empty house for a couple of months, while repairs are being done and, at last, the furniture men have arrived. Of course, I've never personally experienced this but we're speaking hypothetically, of course.

Sunday, 27th March. Had a relaxing day in the house.

Monday, 28th March. I am convinced that the programmers of *Salamander* were on drugs – we're talking major weird here and those guys are what you'd call far out. Yeah, the further the better. Anyway, this reminded me about the second Repoball – I'd forgotten all about that sucker. I'll include him on a hidden level. I'm right into those things.

Tuesday, 29th March. I've redrawn the ground at last. The problem is that it was too big. I clipped it and the structures fell into perpective a lot better. I also adjusted the bullet routine to suit both the Ball and the Saturnians.

Wednesday, 30th March. The Sats are returning fire! This is more like it. I've added an aggression parameter so I can modify the intensity of the attack during the game. Those who become proficient will be met with stiffer oppositon than normally. The power goes down if Repo is shot or rammed now. I'm quite into a the idea of a few kamikaze Sats. All they do is ram and try to damage the ball. Maybe a temporary loss of firepower if three in a row hit you.

Thursday, 31st March. The J.M. Extermination Co. had a bit of a job on its gloved hands today. A tiny little bug evaded me for an hour and was causing alien no.2 to disappear if I shot 1,3 & 4. Just managed to get it in time before I had to leave the game for today.

Friday, 1st April. Repoball's collision detection was on today's agenda. It's time to stop him scrolling all over the structures as it breaks the magic somewhat. It only looks at the necessary pixels for each direction for speed reasons but, once again, more memory is lost because of this. The code now stops at &2718. About 2K left. Looking good.

Saturday, 2nd April. Had a rest and worked on another game I've thought about for a long time. Whilst doing so, I found the inch of time I needed. I also found I'm going off Repoball.

Sunday, 3rd April. Took a day off to think about things. Something's wrong with the game if I'm going off it. I've stuck too damn much to the original ideas I came up with, I think. Time to let let the new ideas roll in.

Monday, 4th April. Couldn't come up with much new, so I just adjusted a few things I've been meaning to do for a long time.

Tuesday, 5th April. Merciless hacking was the solution! I threw away all the stuff that I don't like anymore and started thumbing through a huge pile of computer mags for inspiration. Got quite a few new ideas and graphics. I drew a new mushroom, throwing the old one to kingdom come, wondering how I ever was happy with it in the first place and redrew a lot of the sprites. This is good but I still need more.

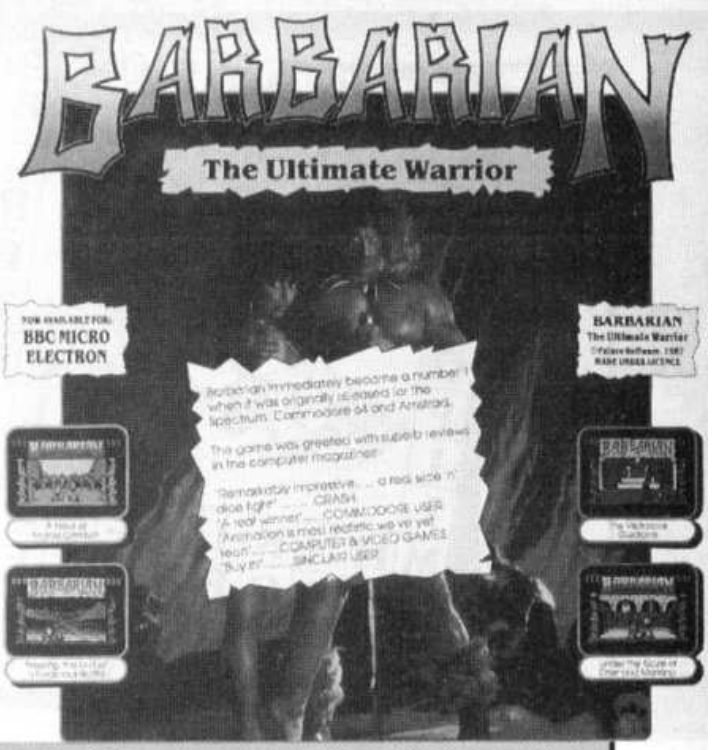
Wednesday, 6th April. We have a new mothership. Instead of flying around it and destroying it, you now fly inside it and destroy everything, with the huge Alien sitting at the end of it, like the brain in *Nemesis*. This is a far better idea and with a few more like it, the game'll pull through.

Thursday, 7th April. Found that the collision routine was only checking 75% of its stuff. Once it was cranked up all the way, the ball could hardly get 'into' anything. Great... this helps improves the overall standard quite a bit.

Friday, 8th April. Faffed about with some

The Ad that says it all. Superior very kindly sent us this copy of thir ad "adapted" by one of our competitors with cold feet. The comment from one of our female contributors was "Thankfully they covered up both Maria and her companion" – What about you, do you think this is a case of double standards or do you think it is an excuse to get even more advertising out of a game.

Write to us at A&B Computing, No 1 Golden Square, London, W1R 3AB. Any letters we publish will receive a bumper pack of games, so give it a go.



Cross out the letters (horizontally, vertically or diagonally) of items that Spycat may wish to obtain, or use.

Rearrange the remaining letters to give the names of two famous double agents to win a super cuddly wuddly Spycat toy (the question remains to be seen if he is more cuddly than those fun loving hunch at Superior).

Also up for grabs are any three games from the Superior catalogue – take a tip and go for one of the compilations, that way, you'll get up to nine games!

Send them in to us – and don't forget to mark them for Spycat's attention ...

new graphics and tweaked a few of the game mechanics. Basically one hell of a boring day.

Saturday, 9th April. Major problem – there's not enough memory to store the moons the way I was going to so I wrote the thesis on the new moon erecter, split into three parts – Erect, Build and Cement. God, I'm having fun these days.

Sunday, 10th April. I tried hard. Let's leave it at that!

Monday, 11th April. Just can't seem to remember what I did on this day. This is one of the problems of not having a 'routine' – but that's cool, I can live with that.

Tuesday, 12th April. Wrote the three routines and started building Leda. Added in the eyeballs and everything went fine.

Wednesday, 13th April. The problem isn't in the graphics, it's in the number of moons. It only takes about 20-40 bytes for a moon, so putting them in isn't hard; it's the fact that I don't have enough memory to generate 14 largely different types of landscape. I was going to repeat a lot of the stuff, but this is how I got sick of the game and it would cause everybody else to do the same. If you're going to be flying about the same sordid landscapes then, sure as fate, you'll get to hate them the same way I do and just go off the game. I think I'll limit the number of moons to 7 or 8.

Thursday, 14th April. A second opinion today was like a fresh breath of air and, as I suspected, the moons needed some sort of stuff sticking out of the roof. *Wizball* having this is the main reason I've dodged it so far but the game just looks very plain with bits just sticking out the moons. The spaceships and ceilings just work better.

Friday, 15th April. One hell of a busy day. I wrote the de-compressor but because of bugs in this and the compressor, I got stuck for two hours until the thing was running smoothly. Then I adjusted the scroll routine to draw things over the entire height of the screen. I'm using the full 26 character rows now and things look very strange with ceiling structures.

Saturday, 16th April. This is the last chance I'll have to finalise everything, so today, for the last time, I searched through the ten Repoball disks and decided what and what not to use. The cactus was re-drawn and apart from that, everything that isn't to be compressed appears to be in. On screen raster space is now zero. There is a slight flicker every minute or so on one of the sprites, but the collision routine hasn't been cranked up to full speed yet, so this, along with an accelerated star routine, should bring things up to scratch.

Sunday, 17th April. Didn't get back till 3am and I sure as hell wasn't starting a nightshift again.

Monday, 18th April. Drew up my 'final list' last night. This details the things that are left to do to finish the game. It's great fun scoring them off. I've had an idea that allows you to go to any of four moons at one time, which means that you aren't restricted to the moons in sequential order. Sure, you can't get at the top levels right away but the program'll give you a fair selection starting from the bottom level going towards the top one. This stops you from getting bored with the same moons, game after sordid game. The moon selection routine only took an hour and looks quite nice with all the different coloured moons (all 24x32) up top. After that was done, I adjusted the scroll routine to cope with the mega moons.

Tuesday, 19th April. I met a Repoball at the local Asda today. Professor Kilger, his designer was right next to him. He was definitely a Thunderbird by the look of him. That banana spray job would get noticed in a wine cellar. Looked like he had the Kilger 502 scatter gun attached to his shell. I had a few words with Kilger about the thrusters and nipped home to try out a new movement algorithim.

Wednesday, 20th April. Okay, I admit I forgot what I did on Tuesday. I'm writing this almost a very long week later you know. Anyway, I thought you'd like a bit of a change. To sidetrack a bit, what gave me the idea was I was coming home on Monday night when suddenly I smelled paint. And when I got round the corner, beaming right at me was this bright banana coloured Escort. To make matters worse, it had been painted with a paint brush!! I kid you not, I could see the damn strokes, the paint was laid on that thick! Poor car!

Thursday, 21st April. Today, I generally mucked around. Today, I nearly blew up my monitor. Today, I had an early day.

Friday, 22nd April. Whipped up a cracking new starfield routine today. It uses bugger all raster and spits out a three-deep parallax field. This kills the flicker and heightens the feeling of depth.

Saturday, 23rd April. Flopped into bed at 4am this morning but I couldn't get to sleep for worrying about the game and the fact that the sun rises earlier these days. This annoyed me 'cause I was tired out after doing the stars all day. I got up at 6am and wrote the Sphere removal code. This removes the Sphere (no surprises there) from the map and the screen, after you've destroyed it. Do in another seven times and you've got the moon.

Sunday, 24th April. Was woken at noon. The sleep did me a power of good and, later on at night, I worked on the sprites, compressing and storing them. I worked out the code for making the ball enter and leave the moons. Can't just blank the screen. That sort of thing went out with flares. I'll just slip the ball off and onto the screen at the top. I originally wanted the ball to 'fall' from a great height and the moon to scroll on from the bottom, but memory free (900 bytes at a stretch) says no joy. Pity. I didn't go to bed again at the end of today.

Monday, 25th April. Went for a walk in the afternoon and came up with and idea for the last level. Didn't get back till late and only got a little done.

Tuesday, 26th April. The ball drops nicely into the moons now and slides straight back out when you want to leave. The maximum height that you can go to on screen is 'safe' i.e. you can't get hit in any way. I'll have to make sure you can't shoot here as well! To leave a moon at any time you just go up to the top of the screen and keep pushing up for about a second and Repo slides up and away. Then you are presented with the moon selection page again and so forth. This let's you leave a moon if you're taking too much of a hammering, to recuperate on a less agressive moon. I'll give free power upon reposessing a moon, I think. The harder the moon the more power.

Wednesday, 27th April. Found a bug in the sphere removal routine. Once fixed, I

worked on compressing more graphics and splitting up the source files yet again. There's now 11 files (about 50k of source) which generate 8131 bytes of object code. *Green Beret* had about 5-6k of object code and *Krakout!* had about 7k worth. Seems to be going up with each program. There's a huge amount of graphics in now, all of them compressed in one form or another. This has got bigger than I ever imagined.

Thursday, 28th April. Started on the latest Saturnian movement routine. Wrote down on paper the basic code and parameters I need.

Friday, 29th April. Didn't have much time for RB today.

Saturday, 30th April. I'm thinking of having different types of isotopes, and any Power-Sphere destruction without balancing the reactor with the proper isotope will mean power sucked from Repo so that the reactor can restabilise. (The reactor can absorb power as well, you know!)

Sunday, 1st May. Entered the new Satz movement routine. It's bugged and will have to wait till tomorrow.

Monday, 2nd May. Little time again. A few bugs were taken out of the new code but still some remain.

Tuesday, 3rd May. At last I've got some time. Got the bugs all out and the new Satz going.

Wednesday, 4th May. Spoke too soon! Found a couple more typing errors and added a new parameter in. Nice movements. Almost weightless.

Thursday, 5th May – Saturday, 7th May. Finished most of the moons. This does look nice! At the end of the slog we see the fruits of our labour. I added a few more patterns as well for good measure. The new isotope thing works well.

Sunday, 8th May. This will be the last entry into the diary. Today I activated the extra power and weapons in the Repo Ball. There is only a few minor things left to do now and to go on would waste space. From here on in, it's polishing and bug-hunting.

And so it goes on. We all thought this would be the grand finale to the diary but John still has his tweaking to do, so more next month.

Games – who's got the games?

One common thread amongst the letters you send me is this – where can we buy Beeb games?

As you know, dedicated computer shops seem to have vanished off the face of the earth, staff at WH Smiths appear to have perfected a company sneer whenever BBC is mentioned, and who can trust mail order companies. After all, can it be long before Esther 'Toothy' Rantzen nails them all for prime time viewing?

Don't despair – all is not lost. Your trusty columnist has tracked down an outfit that gets the Arcade seal of approval – The Impact Games Club. Run by Steve Botterill, until recently the game developer at Superior, the club offers all new releases by mail (200+ games in every catalogue), handy discounts, tips and maps, a monthly magazine and much more. More? Well, enough to keep Steve and pals in beer every month – you don't expect this to be a charity, do you?

But at £2.50 a year, it seems a good deal to me. They're probably too mean to advertise in A&B so you'll have to write to Impact Posters, Neepsend House, 1 Percy Street, Sheffield S3 8AU. That's right – they do those great Superior posters as well. Perfect for covering up the holes in the loo wall.

But do tell 'em I sent you – that way Steve might buy me a beer next time I see him. One thing though – you'll still need to read the Arcade every month for the best in reviews, news and oddments.

And Finally

And finally, things seem to be slipping a bit here in The Arcade. I know there don't seem to be too many new games, but your letters, tips, hints, maps and so on are getting less numerous.

If you've always wanted to see your name in print, this could be a very good time to drop me a line.

I'm awaiting an almost daily influx of dozens of games, so this column may not be too open for too long. Do it now!

Remember, you can write to me at:

Dave Reeder, The Arcade, A&B Computing, ASP Ltd, 1 Golden Square, London W1R 3AB.

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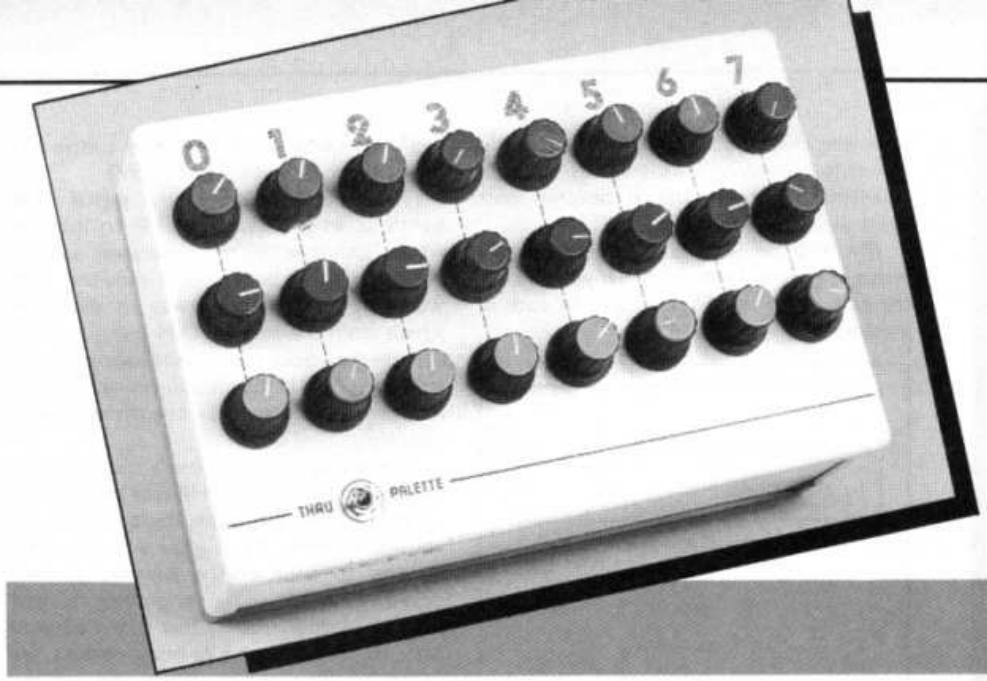


Kevin Kilmoore

You thought we were kidding? Here's how to create over 50 million colours on your BBC Micro or Electron!

RGB RAINBOW

When it was first introduced, the graphics of the BBC micro were considered quite revolutionary. The Beeb is *still* capable of impressive displays by todays standards but it is severely limited by the range of colours available.

Although most modern micros (the Amiga, Atari ST and of course our very own Archimedes) have an enormous "palette" of colours to choose from, the Beeb is stuck with just eight.

If you've ever tried to produce an on-screen portrait, you will have discovered the limitations of pure white or bright red skin! Some other colours can be created by "dithering" – using checkerboard patterns of pixels to create the illusion of new colours – but this reduces the resolution available.

This article will show you how to build an add-on palette board for your BBC micro (or Master, or Electron) which gives you an infinite choice of colours on the screen. It simply plugs into your computer and your monitor plugs into the unit.

It requires no external power, it is relatively simple to build, cheap (around £25) and completely compatible with all your software.

However, we must state now that the palette kit doesn't increase the number of colours available in any screen mode (that would require some quite extensive changes to the inner workings of the Beeb including the custom display chip inside the machine – the video ULA). Instead, it offers a greater choice of colours for the limited number which can already be displayed at any one time.

It operates rather like a hardware version of the software VDU19 command but with an almost infinite variety of colours for the second parameter - and, in all modes, including MODE 7.

Colour

To understand how the Palette unit works, we must take a look at how the BBC micro produces the display you are trying to modify!

The area of memory devoted to storing the contents of the screen (the screen RAM), whether it is shadow RAM in a Master, or normal RAM in a Model B, contains just numbers. It is the job of the operating system to produce the right numbers in this memory to correspond to the intended designs on the screen and it is the job of the video ULA to interpret these numbers into signals which a TV or monitor can interpret as a picture.

The graphics controller chip takes the bytes from the screen RAM in sequence (and extremely fast) and sends them to the video ULA. This splits the serial stream into groups of bits, the length and arrangement of which depends on the screen mode.

The bit groups are then each interpreted as a logical colour for each pixel, the physical colour is looked up from a table set up by the VDU19 command and three signals corresponding to red, green and blue content of that pixel are sent to the various TV and monitor output circuitry and sockets.

The net result of all this frantic work is that the computer produces red, green and blue signals for each pixel in turn as it scans the screen memory. An RGB monitor takes these signals and uses them to control the three electron "guns" in the tube as they scan the monitor screen.

The three colours produced on the monitor screen appear as one composite colour in the same way as dithering. Try looking close up at your monitor or TV screen to see the groups of three red, green and blue dots which make up each spot of the picture.

The problem with the Beeb's RGB output is that it is digital or *TTL*. This means the three red, green and blue signals can only be *on* (when the signal is at +5V) or *off* (when it is a 0V). So only eight combinations of the three colours (eight final colours on the monitor screen) can be produced.

Most other more modern micros use analogue or "linear" RGB signals which can take any of several levels. In this way 256, 512 or even 4096 different combinations – and final colours – are possible.

As the Palette produces an almost infinite number of colours, it will work only with a linear RGB monitor. However, most RGB monitors are linear models (to cater for other micros) and TV/monitors are almost

Parts Needed

Qty	Item	Maplin Code
3	74HC4051 chip	UF06G
3	BC239 transistor	UH56L
3	68R resistor	M680R
3	1k0 resistor	M1K0
3	10k resistor	M10K
3	100nF ceramic capacitor	YR75S
24	10k linear variable resistor	FW02C
1	4-pole 2-way switch	FH08J
3	16-pin DIL chip socket	BL19V
1	6-pin DIN chassis socket	HH36P
1	6-pin DIN line plug	HH29G
3	8-way minicon plug	YW13P
1	10-way minicon plug	RK66W
3	8-way minicon socket	YW23A
1	10-way minicon socket	FY94C
4	packs minicon terminals	YW25C
case (at least 8x6x4in)		LL07H
22swg tinned link wire		BL14Q
connecting wire		
(about 1m each)	red	BL07H
	green	BL03D
	blue	BL01B
	white	BL09K
	black	BL00A
8-core ribbon cable (about 1.5m)		XR06G
6-core round cable (about 1m)		XR26D
50 hole x 24 strip stripboard		FL07H
nuts and bolts for DIN socket		
nuts and bolts or stick-on PCB supports to mount stripboard		
knobs (8 each of red, green and blue)		
grommet for input cable		

Figure 1. The colour chart and combination codes for the final colours

RED	GREEN	BLUE	FINAL COLOUR
OV	OV	OV	black
+5V	OV	OV	red
OV	+5V	OV	green
+5V	+5V	OV	yellow
OV	OV	+5V	blue
+5V	OV	+5V	magenta
OV	+5V	+5V	cyan
+5V	+5V	+5V	white

Figure 1 The digital nature of the BBC micro's monitor output means that only eight colours can be displayed.

always linear. If you are in doubt, you should consult the dealer you bought the monitor from. Some TTL RGB monitors (such as the Microvitec CUB) can be switched to linear

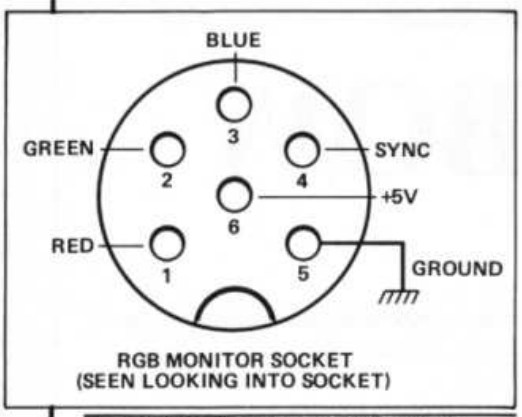


Figure 2 The pinout of the BBC micro's RGB monitor socket.

by a simple internal change – again, see your dealer (but Microvitec consider this a crime akin to wife battery – Ed).

The Palette

The Palette takes the three digital red, green and blue signals and uses them to produce analogue signals of your own choosing *in time* with the digital ones so the picture remains unchanged but the colours are altered.

This mapping of analogue signals onto the digital pattern could be done completely under the control of the micro and, indeed, some commercial palette boards exist to do just that. However, that involves a lot of complex electronics and is beyond most home constructors.

The Palette unit described here uses a series of control knobs to allow you to alter the red, green and blue content of each of the colours on the screen.

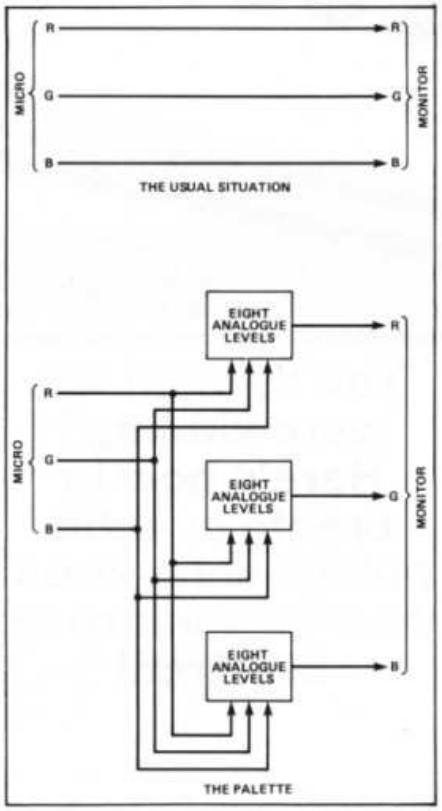


Figure 3 The basic operation of the Palette.

The Circuit

You don't have to know how the Palette works to be able to build it and use it sucessfully but it will help you to cure any problems you may have when building the unit.

The RGB monitor socket on the BBC micro has six pins. The connections to these are shown in Figure 2.

The +5V connection is from the main power supply in the BBC micro and it is used to power the Palette. It is also passed straight through to the monitor output socket on the Palette where it may be used in a TV/monitor for switching from TV to RGB input.

The SYNC signal is another video signal from the computer passed straight to the output. This tells the monitor when the computer is starting its scan of the screen RAM so the monitor can synchronise its tube scan with the computer, so the picture appears in the right place on the screen and "in the right order".

The ground signal is used as a base reference for the other signals.

The red, green and blue signals are the three digital colour signals which describe the colour of each pixel on the screen as it is scanned.

The RGB signals are either "off" – when the relevant pin is at ground potential or "on" when it is at +5V (actually a little less than this but we can consider it 5V).

The Palette unit uses the digital RGB signals as an address (figure 3) to look up which analogue signal generated in the Palette is to be sent to the monitor. This works in a very similar way to the RGB signals from the screen RAM being used to address the colour table used to alter colours with the VDU19 command, however, here the selected colour can be one of many more than eight.

The analogue voltage levels are generated by variable resistors like HiFi volume controls – figure 4. You can adjust these to give any voltage between 0V – ground and corresponding to none of the adjusted primary colour – to 5V – full brightness of that primary colour. So when the adjusted amounts of the three primary colours are added on the monitor screen, you get any colour unedr the sun for each Beeb colour.

The selection of which control is switched in according to the RGB addres is made with electronic switches, connected like the mechanical switch in figure 4 (showing just the red third of the Palette).

The three digital RGB signals from the micro are used to choose which position the switch is in. If the R signal is on and the other two signals are off (the pixel is red and RGB is 001 in binary, or 1) then switch position 1 is chosen allowing the voltage set by variable resistor 1 through to the output.

The switch will select variable resistor 1 each time RGB=1. Similarly when RGB=5 (101 in binary) switch position 5 is selected and the voltage from variable resistor 5 is routed through to the monitor output.

As the computer scans through the screen RAM, a rapidly changing series of RGB "addresses" are output from the micro's RGB monitor socket and so a rapidly changing series of analogue voltages are selected and output to the monitor by the Palette.

Each of the three linear RGB outputs from the Palette uses an eight way switch, addressed by all three digital RGB signals, and each uses eight variable resistors. So for each RGB address (each colour from the Beeb) a new colour can be dialled up on the palette.

The switches are totally electronic and implemented on chips. They are really meant for *multiplexing* - sending several signals down one line – but that needn't worry us.

They have to change switch positions extremely quickly. The monitor screen is scanned in 1/50th second. This works out to be a pixel colour output every microsecond. Not only must the switches manage a million position changes per second but they must actually make each change even faster than that so the signal from the Palette changes cleanly from pixel to pixel, giving a crisp display.

The 74HC4051 electronic switch chips chosen for the Palette can switch at 120 million times per second and take only about 30nanoseconds (three hundred millionths of second) to make each change. Note that the similar 4051 chips should not be used because these cannot switch fast enough to give a clear high resolution picture.

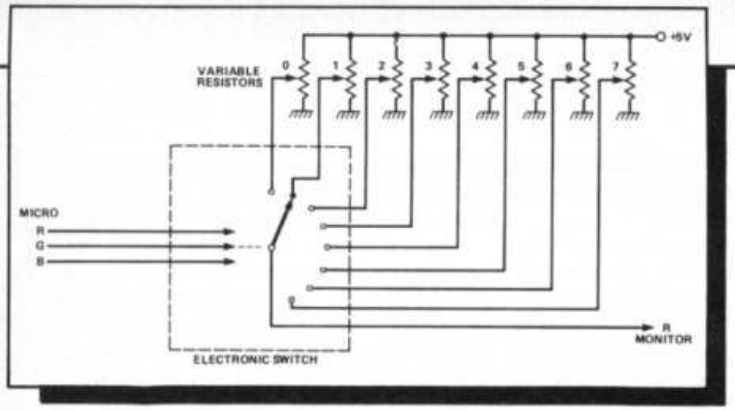


Figure 4 A single colour channel of the Palette.

Even with this kind of speed, the display from the Palette will not be quite as crisp on some better quality monitors as the display straight from the Beeb but it is sufficient quality for most uses.

The complete circuit for the Palette is shown in figure 5. If you are at all knowledgable about electronics, you will see this also includes a bypass switch which directly routes the micro's RGB signals straight through to the monitor to avoid having to reconnect the whole affair when it is not needed.

The outputs from the switch chips are not fed directly to the monitor but pass through transistor buffer stages to produce the right sort of signal the monitor is expecting. These buffer stages are based very closely on the RGB output stages of the Beeb itself.

The circuit also includes three "extra" capacitors. These are used for *supply decoupling* - removing any glitches from the power supply to the chips.

Components

Quite a few parts are needed for the Palette. These are all reasonably easily available from electronic component suppliers. You may be able to find a component supplier near you listed in the Yellow Pages, otherwise a perusal of one of the monthly electronics magazines will provide you with a number of mail order stockists.

I have included the address of the Maplin catalogue, and the parts numbers of all of the Maplin component catalogue numbers in the Factfile at the end of this article.

The choice of a case is left up to you. Component suppliers can provide a wide range of sizes and styles – at a wide range of prices. The one used in the photographs is a simple plastic one with metal front and back panels and measures about 8" x 6" x 4". This should be considered about the minimum size to use.

There is no reason why you should not make a case yourself from wood. An all-metal one is not such a good idea because this can lead to problems with short circuits.

The choice of knobs to fit the variable resistors is also left to you. The prototype used cheap *collet* knobs which can be fitted with different colour caps – handy for identifying the three RGB colours.

The photographs show connections between the board and the variable resistors and sockets using *minicon* plugs and sockets. These are not essential and the wiring can be soldered directly to the board. However, the minicon connectors do make life considerably easier and are recommended.

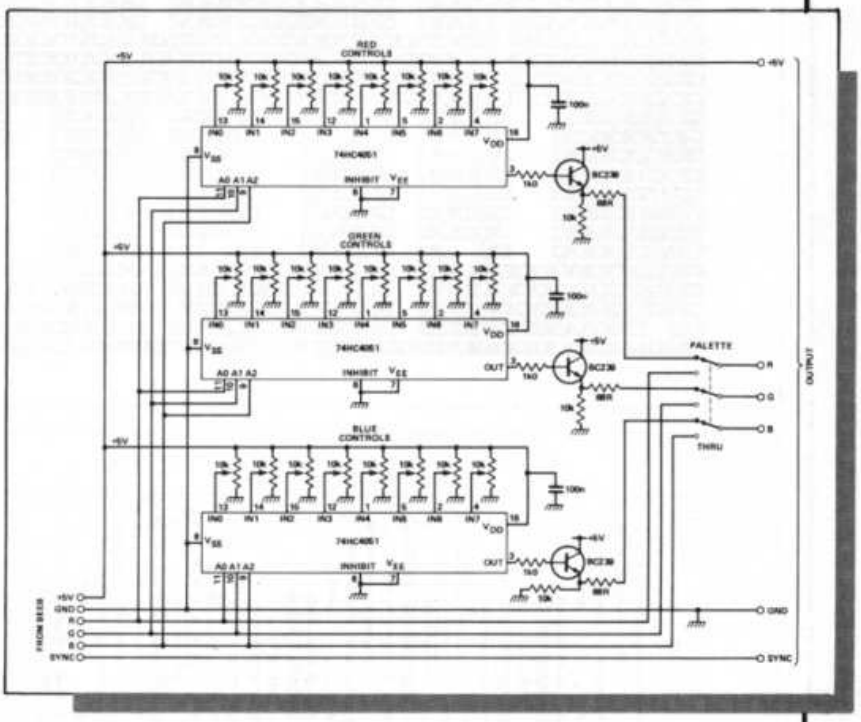
Construction

Once you have collected all the components required you can start the construction itself.

The Palette is constructed using "Veroboard". This is a general purpose alternative to printed circuit board which avoids the difficult and messy etching of the board. Although the nature of Veroboard is also a little detrimental to the high speed performance of the circuit, it is really quite adequate for this purpose.

As well as the components listed you will need a Veroboard *spot face cutter* (although a 3/8 inch drill bit will do just as well), a soldering iron with a fine tip, some solder, a pair of long nosed pliers and some wire cutters.

Figure 5 The complete circuit diagram of the Palette.



The first thing to do is to cut the Veroboard to size. Veroboard comes in various standard sizes so if yours is larger it should be cut to the size shown in figure 6 with a sharp knife or fine hacksaw.

The whole width and length of the Veroboard is not used so as to give room for four mounting holes at the corners. Drill these now to suit the bolts or stick-on supports you are using.

Now you should make the track cuts on the copper side of the Veroboard. The positions for these are shown in figure 6. The spot face cutter or drill bit is rotated in the holes marked so as to remove a circle of the copper strip, breaking the connection. Don't be over enthusiastic. There is no need to drill right through the board!

Be careful to cut the tracks in the right place. Mark the board first and compare this with the diagram before you make any irreversible cuts.

Next, all the wire links should be soldered in place on the board. Figure 6 shows the positions of all the components on the board. There are 37 links and it is worth while spending a little time doing them neatly.

For each link, cut a piece of tinned wire a little longer than required. Now bend the two ends at right angles to the centre portion with the correct distance between the bends to fit the layout shown. Preforming the links in this way will ensure they do not touch each other or come loose later. Insert the links in the correct positions from the blank side of the board and then solder each end carefully on the reverse (copper strip) side.

Solder the chip sockets in next. Take especial care not to "bridge" the fine gap between adjacent pins with excess solder. Now you can solder in the nine resistors and three capacitors.

When you come to solder in the transistors, take care to insert them the right way around. Note the shape of the case in the diagram. Don't apply too much heat to these as that can damage them. Leave the transistor to cool for a few seconds after soldering each lead. Gripping the lead you are soldering, on the other side of the board, with the pliers is a good method of keeping the component cool but this is relatively tricky and requires at least three hands!

You will notice that all the components on the board except the 68R resistors and one wire link are arranged in a pattern which repeats three times along the board. This makes life easier when locating the correct positions for the components and makes checking the final result relatively simple.

Factfile

The Maplin catalogue can be found in branches of W.H.Smiths and Maplin can be contacted at PO Box 3, Rayleigh, Essex SS6 8LR. Tel: (0702) 554155.

The next step is to install the variable resistors and the input lead and output socket.

Drill 1/2 inch holes for each variable resistor in the top of the case at the spacing and positions you want. Drill a further 5/8 inch hole for the socket and a 1/4 inch hole for the input cable. Bolt the variable resistors and the DIN socket in position.

The variable resistors, input plug and cable and the DIN socket are wired up as shown in figure 7. This looks immensely complicated but in fact it is relatively simple. Again, the variable resistor wiring follows a simple pattern which repeats itself three times.

Using the correct coloured wiring for the interconnections will help you to follow the circuit and to check the result.

The last bit of soldering is to connect the ribbon cables and the other wires to the board. This is arguably the trickiest bit of the whole operation. Although the "minicon" plugs and sockets add to the cost, it is probably worthwhile using them for peace of mind.

The male socket half of each connector simply solders straight into the positions marked on the board. The female plug halfs are made up by crimping individual spring terminals on to the ribbon cable wires and inserting these into the socket housing. Note the arrowed end of the plug must match up with the arrowed end of the socket as shown in figures 6 and 7.

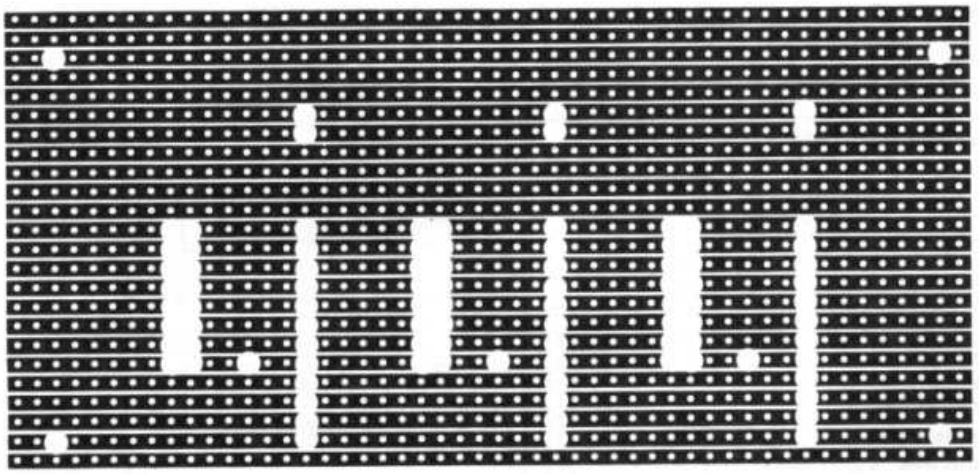
When all the soldering is done (and carefully checked), the switch chips should be plugged into their sockets. This is not as easy as it sounds at first. These chips are sensitive to static electricity and can be completely (internally) destroyed by careless handling.

Spread a piece of kitchen foil on your workbench and put the board and the chips (unpacked from their protective wrapping) onto this. Now, holding the chips by the black body part only, carefully plug them into the sockets on the board just as you would plug a ROM into the Beeb. Note the orientation of the chips. They are all inserted with the notch away from the transistors.

Now you're ready to connect up the minicon connectors, bolt the board into the box and plug in.

Testing

With the completed Palette plugged into the RGB monitor socket of your BBC micro and the monitor plugged into the Palette, select mode 2 and type COLOUR 1 <Return>



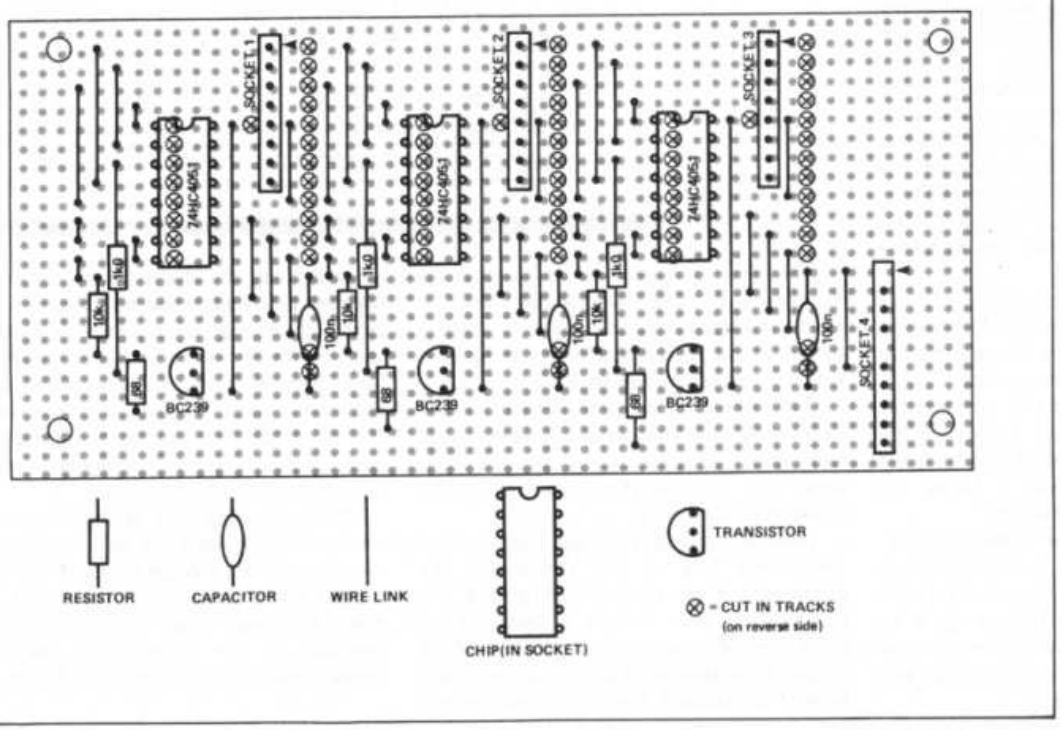


Figure 6 The positions for the track cut on the copper side of the Veroboard and the positions for all the components on the upper side.

COLOUR 2 <Return> and so on up to 7 to display all the colours on the screen.

Flick the Palette switch to **Thru** and the display should be as normal. If it isn't, unplug the Palette, take it apart again and disconnect the 10-way minicon connector from the board and try again. If this cures it, the problem is on the board. If the fault still occures the problem is with the wiring from input cable to switch and back to the socket.

Once the Thru mode is correct, turn all the variable resistors anticlockwise and flick the switch to Palette. The screen should now be blank. Leaving the 0 variable resistors alone, turn the others one at a time to see the effect on the screen. Each column of knobs should affect one line of text on the screen (one colour from the Beeb). Each row of knobs should affect the overall quantity of each primary colour.

If the arrangement you find is different, suspect the wiring of the variable resistors and their connection to the board.

Other faults are going to be a matter of checking the entire board. Search for incorrect placing of components or track cuts, solder bridging between tracks, cracked tracks and the chip pins not making proper contact with the socket.

If it is one row of knobs which is having the incorrect effect, you can concentrate on the corresponding third of the board.

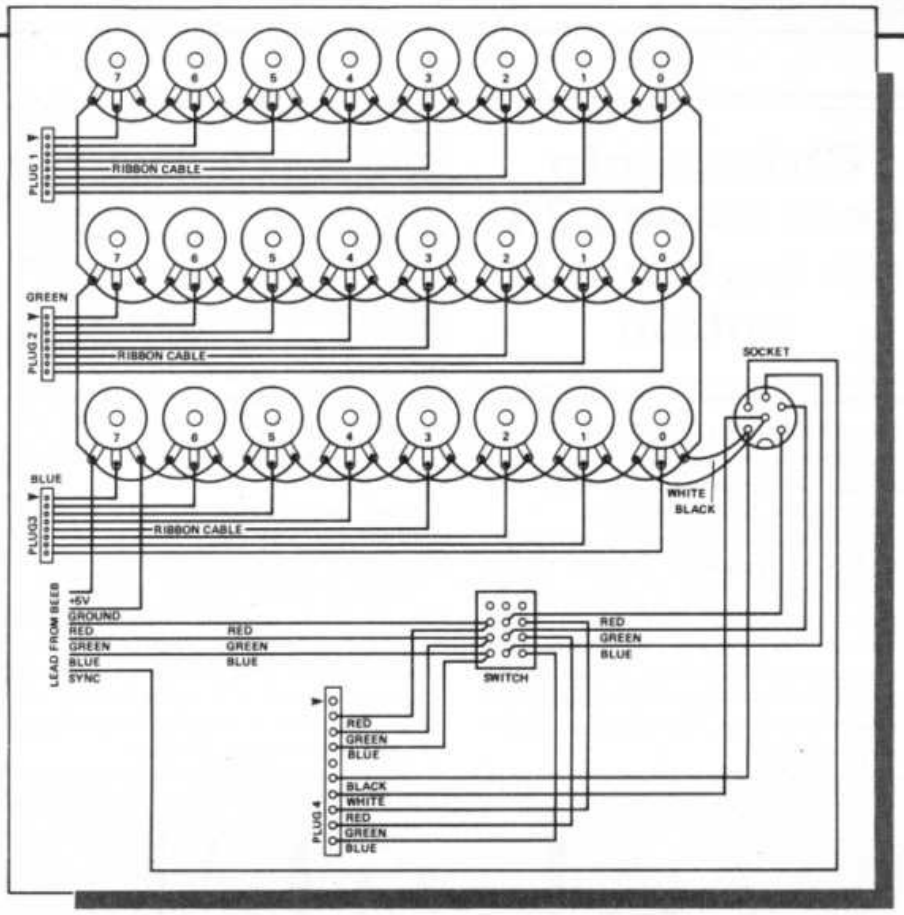


Figure 7 How to wire the completed board to the variable resistors and socket inside the case.

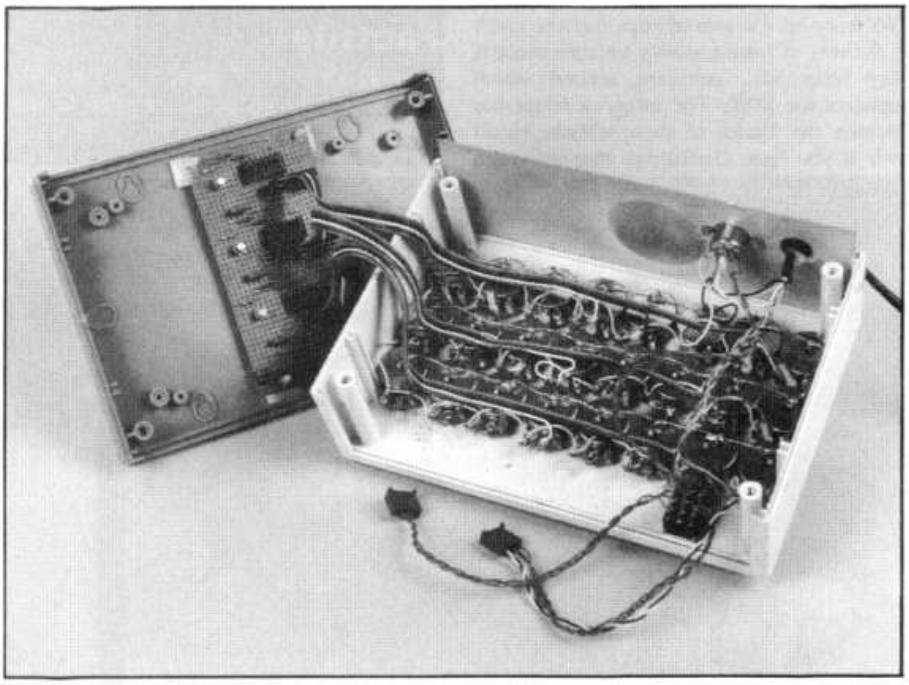
Variations

So far we haven't touched the colour 0 variable resisters. When you have got the rest of the Palette operating correctly these can be turned to check their effect – this will depend on the monitor being used.

Some monitors allow black areas of the screen to be changed in colour just like any other colour. In this way you can even change the colour of the border around the picture. One cheap monitor which allows this is that supplied with the Amstrad CPC micros!

Other monitors – particularly those relying on the 21-pin *Scart* connectors for their input such as Acorn's colour monitor – use the black signal as a base reference level for all the other colours and so messing around with that messes up everything else.

However, even with these monitors the colour 0 knobs can be put to good use. On the three colour 0 variable resistors, swap around the two outer connections. This effectively reverses the effect of the knob.



You still cannot control the displayed colour of black areas of the picture but these three knobs now control the overall colour balance. Turn the red colour 0 knob clockwise and the amount of red in all the other colours (as set by the other knobs) will be increased in proportion. Similarly the other two colour 0 knobs control the total amount of blue and green displayed.

Palette Power

Because the Palette unit affects only the outgoing signal from the Beeb's RGB monitor socket, it is completely compatible with all software.

You must bear in mind that this also means it is the physical colour which the unit uses to address the control knobs and not the logical colour. So, for example, after entering **MODE 1** the three screen colours (four if your monitor allows black to be substituted) can be altered to your choice using the knobs in columns 1, 2 and 7 (corresponding to the normally displayed colours red, yellow and white). Only in MODE 2 can all seven (or eight) sets of knobs be used.

If, however, you change the Red to be displayed as, say, magenta (*with a VDU19,1, 6,0; command-* Ed) then this colour is then controlled with knobs in column 6 – corresponding to magenta.

If you find the control is not acting as you believe it should, it is a good idea to switch the unit to the "Thru" position to see which physical colours are being used and to use the corresponding columns of knobs to alter these.

It doesn't take long to master the knack of using the Palette and after a few practice runs you will have a Beeb which can, in one respect at least, match any other micro available.

Ann Owen

Citizenship now means 24 pin and colour option

Citizen's HQP-40 is a 24 pin, 80 column dot matrix printer with options for seven colour operation and automatic sheet feeder. The price of the standard model is £499.

If you are thinking of moving up to 24 pin from 8 or simply entering the printer market for the first time, the HQP-40 looks an attractive proposition. On test it carried on where the old 8 pin left off but with much increased speed (200 characters per second in draft down to 66 cps in letter quality) and efficiency (a large print buffer lets you get on with your work).

of the Epson LQ800 which handles most BBC printer drivers. Various font cards are available if you wish to take advantage of different print styles from your own software. It is unlikely that BBC software will support these alternative fonts although printer drivers (eg View family) can be adjusted to suit. Fonts available are Times, Helvetica, Prestige, Univers, OCR B and Roman Script.

The DIP switches will not need much adjustment when using the HQP-40 with a BBC Micro but if linefeed control or the like does need changing then the switches are instantly available beneath a plastic hood in the front panel.

Front panel controls are used to select fonts and type styles as well as to perform line and form feed and on/offline switching.

The HQP-40 has a bigger footprint than some 80 column printers because of its solid design and it turned some heads in the office because it was certainly noisier than the 8 pin printer it replaced. I like Citizen's neat, thin manuals and there is a section on setting up for a BBC Micro, among others.

The other noticeable improvement is in paper-handling. It is excellent on this machine. A sensor picks up the positioning of sheets into the guide or continuous paper on the tractor mechanism and smoothly pulls it into place beneath the print head.

The tractor (pin) feed can be push or pull. Some couple of years ago the push feed mechanism was introduced on printers as an improvement because it did not force the wastage of paper when tearing off sheets. Many new printers however have retained the traditional push operation. On the HQP-40 Citizen have decided to offer their customers both!

Also included is a robust single sheet guide, with two choices of position, one more upright than the other. There is a paper thickness lever to adjust for multiple copy documents or envelopes although the latter seemed to slip through unhindered without change from the default position.

Slots and Switches

Two slots in the body of the printer, front right and beneath the lid, take an emulation card and a font card. The built-in emulation is

Colour Crisis

The story here is one of hope but not much in the way of results, mainly because there is very little BBC software around which supports the JX80. The Integrex inkjet has become the choice of most schools. However if you have Cambridge Micro's Image

software you will be able to take advantage of this option.

The colour option consists of a new motor which you have to install yourself and a ribbon with black, red, blue and yellow inks. For once the manual left me guessing for a few minutes on the exact location for the motor extension but it slotted in neatly enough when I had worked it out. The motor unit is needed to move the ink ribbon so that the appropriate colour is positioned behind the print head.

Things are more hopeful for the Archimedes owner because software houses are more aware these days of the need to support as many printer standards as possible. Artisan supports the JX80 standard as does First Word Plus. Unfortunately neither of these pieces of software were entirely successful in conjunction with the HQP-40. Artisan Support made a nice job of the colours but it took more than one try to get a solid picture without some thin white lines appearing intermittently. First Word Plus, with JX80 driver installed, interpreted some of the colours a little strangely but, by selective use of colour, some nice effects are possible.

The HQP-40 certainly outstrips the old Integrex in every other department and because 24 pin printers are supported by most major packages, it looks a good all-rounder for the Archimedes owner.

Factfile

HQP-40 £499. Font cards £35. Emulation cards £50. Ribbon £8. Colour kit £50. Colour ribbon £20. Sheet feeder £150.

The NEC can produce (separate from the self-test) a printed report on the current settings, which are stored in non-volatile memory, and changed via a "dialogue" using buttons on the front panel. Hence there are no DIP switches, but the font module socket is at the rear. The DIP switches of the Epson have a capacity of only 16 bits, while the EEPROM of the NEC can store at least 33 bits. Hence, where the Epson can store page lengths of only 11 or 12 inches, the NEC can store one of twelve – including, most notably, the 11 ⅔ inches of "true A4".

The printer buffers are each of 8K, some of which may be set to hold user-defined characters. However, their use as buffers is of less significance with printers which are relatively fast.

page. Hence it is necessary to wind the paper back by hand by five lines, to align the top with the top of the printing track (the black rubber insert in the metal platen). With either printer, you can adjust the paper for top-of-form while the power is on, but this is not recommended, and it is easier if the power is off.

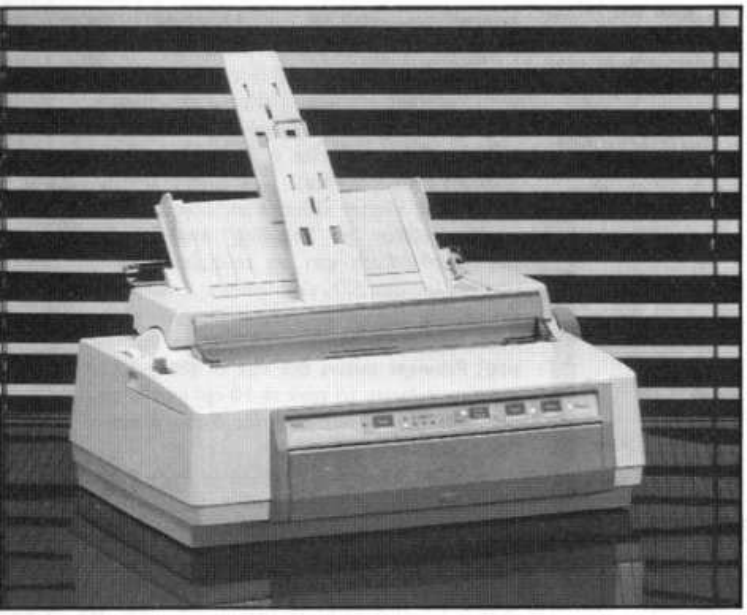
The major difference in paper handling between the two printers arises when you want to print alternately on fanfold and cut sheets (or envelopes). With the Epson, you have to unthread the fanfold paper, move a lever from tractor to friction feed, and remove the tractor unit, by pressing it backwards, and then lifting it off (the top cover should also be changed over). The cut sheet (or envelope) may then be loaded and printed. At least, when replacing the tractor unit, a ramp automatically moves the lever back to the tractor setting.

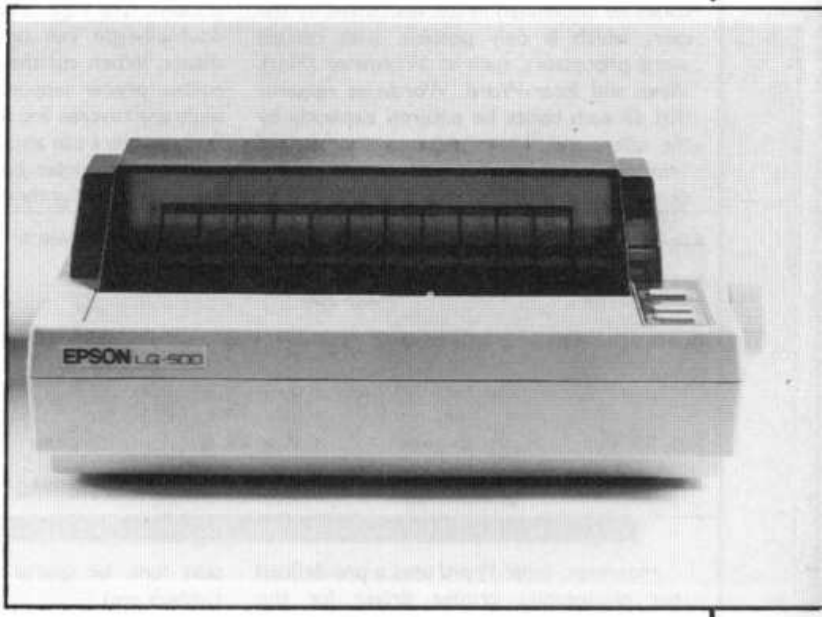
series (which features most often in lists of printer drivers).

The DIP switches of the Epson and the EEPROM memory of the NEC can be set to determine the default font – whether one of those resident or that in the optional-font socket. In addition, both printers have a number of front-panel buttons for immediate control. The Epson "SelecType" button allows selection of the Draft and the two or three LQ fonts in turn, and must be done with the printer on-line. Conversely, the NEC buttons allow selection of Draft or LQ (one font), Print Style (size), and Quiet (half-speed) or normal, and must be done with the printer off-line.

Both printers are capable of proportional spacing, but *ArcWriter, Graphic Writer,* and *First Word Plus* cannot handle this together with full justification. However, the forthcoming Arc word processors from BBC Soft and Computer Concepts are both expected to be capable of this. Performance As with the printing tests in last month's article, I measured the time taken to print the 4000-word "Byte" document. It is not completely representative of normal text, in that it is formatted to 80-columns, and is divided into 40 paragraphs – exactly as used for testing word processors. Contrary to the respective claimed speeds, on this test document the NEC is just faster than the Epson in draft mode, and more so in LQ mode. (See Fig. 1).

The NEC was noiser than the Epson in both Draft and LQ mode but both are quieter than a (much slower) daisywheel printer. On the NEC, half-speed can be selected with either Draft or LQ, both via software, and with the front panel buttons, but this is 2-pass (rather than 1-pass), and reduces the throughput to less than half.





Paper Handling

Both printers have pull tractors for handling continuous fanfold paper. However, the NEC tractor can also push the paper, which allows easy tearing off, and avoids wasting a sheet of paper with every new print run. Furthermore, it is both simple and reliable in action. Both printers also have friction feed for handling cut sheets.

For single sheets, the Epson, with its double-sided vertical guide, is somewhat better than the NEC, where the paper needs to be hand-fed horizontally, against a single-sided guide – which is harder to get square. They also have the option of a mechanical cut-sheet feeder.

The Epson may be auto-loaded with cut sheet paper, using the single-sheet guide, and pressing the Auto-Load (Line Feed) button, whereupon the top of the paper is positioned level with the print head, on the first line. The NEC can also be auto-loaded – not just with cut sheet from the front slot, but also with fanfold by the push tractor. However, in both cases, the top of the paper is positioned level with the tear-off edge, which is some way above the print head. This means that nothing can be printed on the top five lines, and all the text is shifted down the page, so that the footer may spill over onto the next

I tested both printers with fanfold paper, using the standard pull tractor on the Epson, and the push tractor on the NEC, as well as with cut sheets. The former is very suitable for program listings and draft documents, while the latter is ideal for final documents. The cut-sheet feeder for the Epson is priced at £75, and that for the NEC at £67, both plus VAT. I did not test them, but they enable the automatic feeding of cut sheet paper – which is less expensive than fanfold – and at these prices they look very attractive. Indeed, NEC report that some 35 to 40% of P-2200s are fitted with sheet feeders.

Printing Capabilities

Most Arc word processors, such as *ArcWriter, Graphic Writer,* and *First Word Plus* can access the standard printer repertoire of plain, italic, underlined, subscript, and superscript text, in normal and bold Letter Quality (LQ), at any single character pitch, (normally 10 cpi). Both *Graphic Writer* and *First Word Plus* can also handle embedded graphics, including colour (output as either shades of grey or in colour, depending on the printer). As with 9-pin printers, Epson defined the "standard" for 24-pin printers, with their LQ

Party Tricks

These 24-pin printers are incredibly versatile, with many features beyond the standard repertoire of an Epson (FX) 9-pin printer. The NEC has no fewer than 256 resident

print styles. Each printer offers double width and double height (and the NEC has triple width), but the Epson has a more impressive variety of styles, including outline and shadow, and both together, and combined with double-width and double-height (see Figs. 2 and 3). In addition to the features of the "LQ" standard, (accessed by control codes such as FF, and Escape sequences, starting with ASCII decimal 27), the NEC has other options (accessed by FS sequences, which start with ASCII decimal 28 – where FS stands for File Separator).

ArcWriter, Graphic Writer and *First Word Plus* are only intended to handle the standard repertoire of character styles, via the particular control codes that are included in their printer drivers. The above size and style variations thus require that the control codes be embedded in the document by the user, which is only possible with certain word processors, such as *Wordwise (Plus), View,* and *Inter-Word. Wordwise* requires that all such codes be entered explicitly by the user, and *View* requires the use of "extended highlights" with a special printer driver.

Features of the Epson LQ-500

It comes with two resident Letter-Quality fonts :

Roman, and Sans Serif,

and can be fitted with one of four Font Modules,

such as this Courier.

As well as the basic font, it can do variations :

outline, shadow, and **outline with shadow.**

In addition to the usual sizes and styles,

it can print double-width, double-height,

double-width with double-height,

and with variations.

The NEC, double-height is not corrected automatically, so the paper position is wrong thereafter. Although acceptable results can be achieved by trial and error with both printers (see Figs. 2 and 3), with the NEC, double-height can only be used on single sheets. When cut-sheet feeders are in use, neither printer supports double-height styles, since any reverse line feeds are then ignored. Both printers can also use characters downloaded into printer buffer RAM- whether a standard font slightly modified, or an all-new text font, or special characters (eg logos, symbols etc).

There are several such products for the Model B/Master series driving 9-pin printers (eg from CJE, PMS, and Watford). However, I do not know of any commercial products for driving 24-pin printers – whether for the Model B/Master or the Arc. Printing Graphics I showed examples of documents with embedded graphics in last month's article, using *Graphic Writer* with a 9-pin printer, and *First Word Plus* with a 24-pin printer. Since 9-pin printers print (plotter) graphics at 72 dots/inch, and 24-pin printers print 8-bit graphics at 60 dots/inch, the latter produce images which are 20 per cent larger in width and height. To output a *Graphic Writer* document which includes graphics, with a 24-pin printer, you need to run the PRINTCON program, to reset the graphics code. Thus the default of ESC "*",5,0 (for a 9-pin printer with "plotter graphics") should be changed to ESC K. This is the equivalent of ESC "*", 0 (which is the code for a 24-pin printer to produce 8-bit graphics).

Graphic Writer includes an "object-based" graphics editor (or "drawing" module), the results of which can be re-scaled (eg to correct for the 20% enlargement), while still preserving the original aspect ratio. However, this requires some care, since the (full size) Preview shows the size of the printed graphic- relative to text at 10 cpi and 6 lines per inch (lpi) – but only for 9-pin printers using "plotter graphics".

In *GW*, re-scaling is done in Page Composition, which uses a "Mini Preview" to show both (greeked) text and graphics. After adding the graphic to the text, you use the right Adjust button of the mouse to drag the width to the desired magnitude. (eg, to produce a graphic which will be 80-columns wide when printed with a 24-pin printer, you align the right-hand edge with the 80/1.2 = 66th column). Then you click on the "Proportional" icon, which automatically re-adjusts the graphic to the original aspect ratio. However, since it does this by pushing up the top edge, you may have to re-position the graphic by clicking with the left Select button, and dragging it bodily down.

In *First Word Plus*, it is easy to see whether the graphic is suitably sized for

Fig. 1 24-PIN PRINTER PERFORMANCE

Byte document 4000 words	Epson LQ-500		NEC P-2200	
Draft, 10 cpi	1-pass	4 m	1-pass	3 m 58 s
Draft, Quiet	-	-	2-pass	10 m 30 s
LQ, 10 cpi	1-pass	9 m 20 s	1-pass	9 m 2 s
LQ, Quiet	-	-	2-pass	20 m 52 s

However, *Inter-Word* uses a pre-defined (but changeable) printer driver for the standard repertoire, while any (other) control code sequence can be embedded anywhere in the text. This can only be done via a menu (ie not from the keyboard), but it can handle control code sequences of up to 30 characters – including the commas required as separators – allowing multiple commands to be embedded in a single location. As well as conventional control codes, Inter-Word can handle the unusual FS codes of the NEC. However, you must not embed the codes 27,64 (ie ESC "@") to initialise either printer on the same line as any text, otherwise it will not print ! *Inter-Word* cannot give an accurate on-screen preview of such multiple width and multiple height characters – so you have to resort to test printouts.

Of course, one of the main purposes of a page layout or desktop publishing package is to give an accurate preview when using a range of point sizes (and fonts), as well as to handle embedded 3 graphics. These features are likely to be included in future Archimedes applications. Multiple-width characters cause problems with line length and justification, but multiple-height characters may cause even more problems with page length. With the Epson, double-height is corrected automatically with a reverse line feed- although it does not work too well with a pull tractor.

Features of the NEC P-2200

It comes with four resident Letter-Quality fonts :

Courier, Super Focus, OCR-B, and ITC Souvenir,

and can be fitted with one of 12 Font Modules.

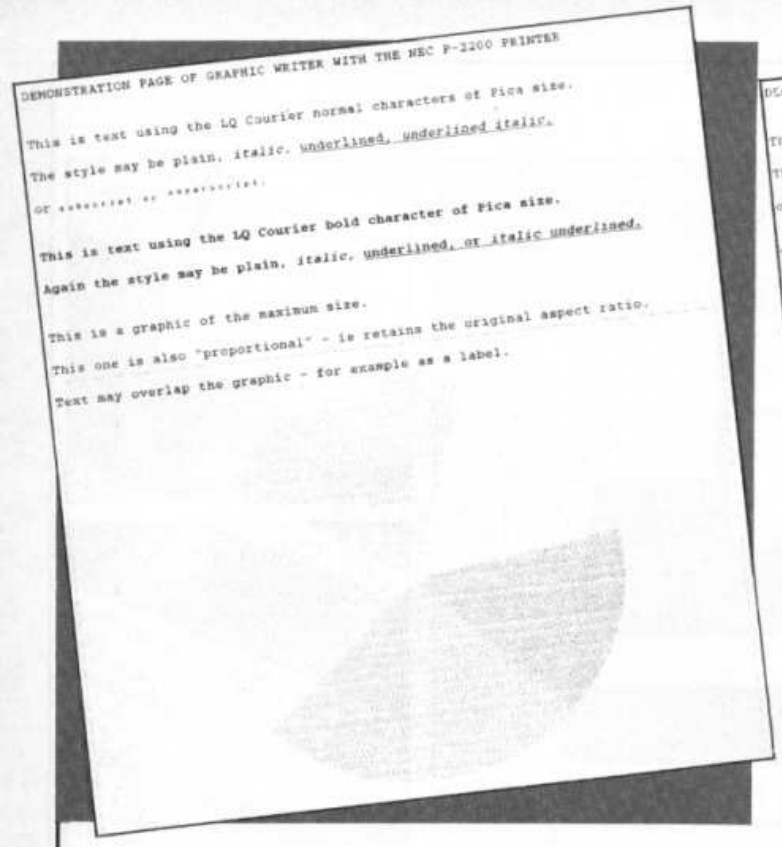
In addition to the usual sizes and styles,

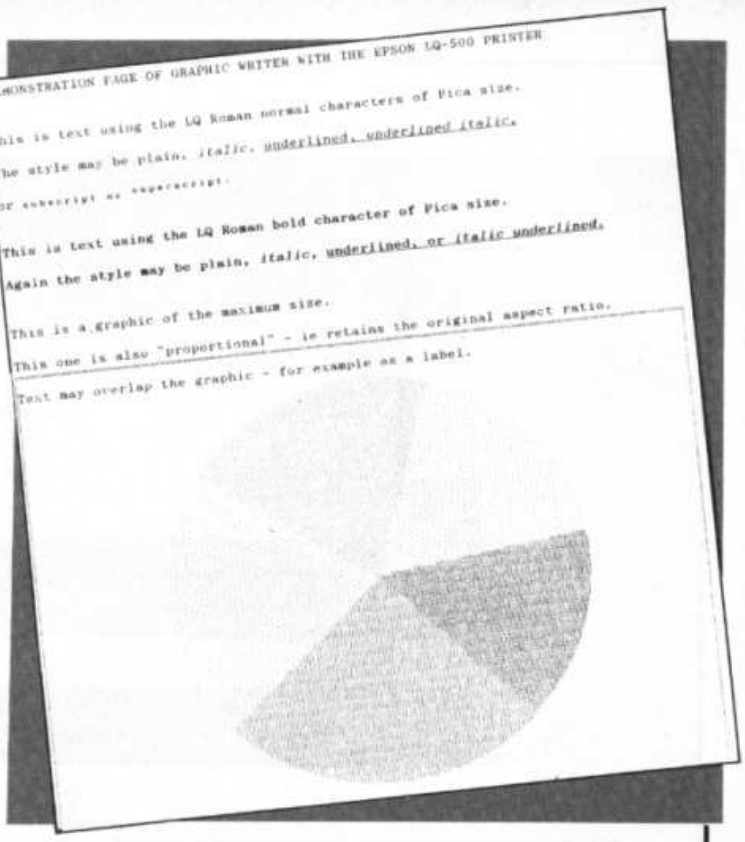
it can print double-width, double-height,

double-width with double-height,

triple-width, single,

and triple-width, double.


DEMONSTRATION PAGE OF GRAPHIC WRITER WITH THE NEC P-2200 PRINTER
This is text using the LQ Courier normal characters of Pica size.
The style may be plain, italic, underlined, underlined italic.
This is text using the LQ Courier bold character of Pica size.
Again the style may be plain, italic, underlined, or italic underlined.
This is a graphic of the maximum size.
This one is also "proportional" - ie retains the original aspect ratio.
Text may overlap the graphic - for example as a label.


DEMONSTRATION PAGE OF GRAPHIC WRITER WITH THE EPSON LQ-500 PRINTER
This is text using the LQ Roman normal characters of Pica size.
The style may be plain, italic, underlined, underlined italic.
This is text using the LQ Roman bold character of Pica size.
Again the style may be plain, italic, underlined, or italic underlined.
This is a graphic of the maximum size.
This one is also "proportional" - ie retains the original aspect ratio.
Text may overlap the graphic - for example as a label.

output with a 9-pin printer using "plotter graphics", or with a 24-pin printer. The size of the printed graphic – relative to text at 10 cpi, and 6 lpi – is shown on screen by a dotted outline, and this changes automatically with the printer driver.

However, *FWP* handles only bit-image/ sprite graphics, and does not support scaling or cropping. Hence, to change the size, you must go back to the "painting" program (eg *Welcome Paint*, or *Artisan*), change the graphic by cropping, or by re-"painting", and import it again into *FWP*. I used *GW*- but could equally well have used FWP- to create almost the same text and graphics documents for both printers. (see Figs. 4 and 5). The graphics shown here are all 8-bit – which is all that the printer drivers in GW and FWP support at present.

To correspond with the GRAPHICS screen-dump utility supplied with MS-DOS for 9-pin printers, NEC offer two 24-pin screen dumps – one for CGA and the other for EGA. The former would be of interest to users of the Arc PC Emulator. NEC also offer 24-bit graphics drivers for a large number of PC packages, such as *PageMaker* and *AutoCAD*. These are available free on request. Hopefully someone will soon produce 24-pin screendumps for the Model B/ Master and the Arc, either standalone or perhaps incorporated within their applications.

These would match the 9-pin screen dumps available in Computer Concepts *Printmaster* (and similar ROMs), and the *HARDCOPY dump built into the Arc Operating System, Rather than the rotating hard rubber roller (platen) of the Epson and most other printers, the NEC print head hits the paper against a stationary rubber-covered metal strip. Although this allows all the pins to travel the same distance, and so might be thought to reduce the "banding" effect visible in grey-shaded graphics, no real advantage was apparent. (see Figs. 4 and 5).

Conclusions

The list prices of these two 24-pin printers are very close (Epson £385, NEC £395 both plus VAT). Both can be found at substantial discounts – down to around £295- but you should not then expect much after-sales support. These two machines are thus well within the reach of many home and small business users. Moreover, their versatile paper handling and speed and quality of printing enables them to outperform two printers (eg a 9-pin dot matrix for draft, and a daisywheel for correspondence).

Furthermore, both these printers have foot-prints smaller than an Epson FX-80, and are light and easy to move.

Choosing between these 24-pin printers is just a matter of your priorities. The NEC P-2200 offers excellent handling of both fanfold and cut sheet paper, and more fonts as standard. While the pull tractor of the Epson LQ-500 impedes the changeover between fanfold and cut sheets, the print quality is even better, the speed about equal, and it is quieter. Paper handling may be more comparable when sheet feeders are fitted.

These 24-pin printers are excellently suited for use with the Model B and Master Series. For example, *Wordwise*, *View*, and *Inter-Word* afford access to most of their text facilties- including those beyond the standard repertoire of 9-pin printers, such as a choice of fonts. Among the Archimedes word processors, *ArcWriter*, *Graphic Writer*, and *First Word Plus* can access the standard repertoire- the last two with embedded graphics. Moreover, forthcoming text and graphics applications for the Arc should allow full use of proportionally spaced text, and the far better graphics.

Factfile

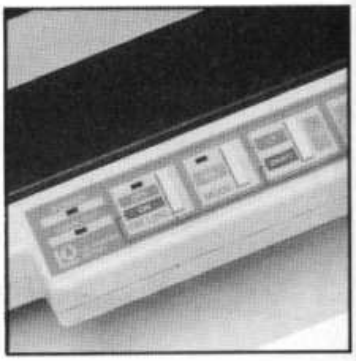
- **Epson (UK) Ltd Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. ☎ 01-902-8892**
- **NEC Business Systems (Europe) Ltd NEC House, 1 Victoria Road, London W3 6UL ☎ 01-993-8111**

Trevor Attewell

The Amstrad LQ3500 24-pin letter quality printer will work with IBM PC compatibles and any other computer that has a standard (Centronics) parallel interface, ie all BBC machines. It measures 436mm wide x 335mm deep x 85mm high overall, excluding connectors, detachable tractor and paper guides, and weighs approximately 6 kg.

The tractor unit was not supplied for review. When it is not fitted, the open top of the printer can be covered by two plastic flaps, one of which has a slot through which the paper feeds, and is equipped with two adjustable paper guides which fold down when not in use. These are rather tatty, and inspire little confidence in their longevity. The other flap is lifted to obtain access to the ribbon cartridge, and appears to be usable with the tractor fitted. There is a protruding ledge on the right front, which carries four switches – these include the normal on-line, line feed and form feed functions. The fourth switch, labelled MODE, modifies the operation of the line and form switches, reducing the line feed to 1/80 inch, and changing the form feed to reverse line feed. These switches can also be used to select draft or letter quality. The usual DIP switches are fitted, and a good feature of the design is that these are immediately accessible through a cut-out in the rear of the case.

A convenient automatic feed can be obtained when the printer is switched on, by offering the paper into the rear of the roller,



and pulling back the bail-bar lever on the right of the printer. The print head then moves to the middle and the paper is automatically fed forward, finishing with the print head about 30mm below the top of the paper. Once loaded, the paper was not very well held by the rollers, and it was all too easy to knock it out of square during printing. The claimed printing speeds for standard type (80 characters per line) are 135 CPS (draft) and 45 CPS (LQ). The measured speeds, including line feeding and all other overheads, were 80 and 36 CPS respectively.

The LQ3500 can produce Epson, or either of two IBM fonts. All character sets can be in standard or italic styles, and can be selected either by DIP switch or by software control codes. The typefaces available are pica, elite, condensed, proportional and LQ, any of which can be in subscript, superscript, double-strike, italics or bold. Any of these combinations can be underlined or printed in double width. Downloaded character sets can be used, and codes from 0 to 127 are accepted, but those which duplicate control codes will not be printed – for obvious reasons.

The printer has an 8K memory, in 2x4K of RAM, of which 1K is reserved for downloaded characters, and the remaining 7K is the printer buffer. This is a useful buffer size, which would mop up roughly a full page of A&B text.

It is possible to get a printout of the ASCII code (in hex) for each character sent to the printer, for example, when listing a BASIC program. The ASCII codes are followed, on the right of the paper, by the characters themselves. This facility is only available at switch-on, and is dancelled by turning the printer off again.

Hot Head

Single, double and quad density graphics are available, giving 480, 960 and 1920 printing positions per line, respectively. However, the use of graphics did pose some problems on the review sample. The print head has 24 pins in two vertical lines of 12 each, and the firing pattern depends on the printing mode in use, all 24 being used for 24-bit graphics. The problem is that the head is inadequately cooled, having little in the way of a heat-sink and no cooling fins. Although there is a brief pause at the end of each line to reduce the duty cycle slightly in this mode, the head still gets extremely hot after a few passes of black background. If printing is allowed to continue, a thermal cutout stops it for a cooling-off period at about 130 degrees Celsius. On the other hand, restricting oneself to 8-pin mode gives thin results. This seems to sacrifice much of the potential benefit from the use of 24 pins in graphics modes.

It is also worth noting that although standard printer dumps, designed for ordinary 8-pin printers, do work after a fashion in 24-pin mode, they give thin and dimensionally distorted results, due to the different printing modes involved. Some dumps specifically for 24-pin printers have been published, one of which was used for test purposes (briefly!). Doubtless 24-pin dumps will soon be widely available.

Thanks Amstrad!

Normally a printer review should be illustrated with some print and graphics examples. Unfortunately, the review sample arrived in distinctly second-hand condition, with no tractor or paper separator, a loose connector and a well thrashed ribbon. A replacement ribbon was sent, which proved to be a carbon type instead of the proper inked one, and consequently useless for practical purposes. By this time it had also been discovered that one or two of the lowest pins appeared not to be printing reliably. On inspecting the circuit board a modification confirmed my suspicion that the printer supplied was an early sample.

It is unfortunate that a looming copy date left insufficient time to obtain a full production sample of this printer in ex-factory condition, but the bottom line is that one can only review what is received. On paper the LQ3500 looks good, has some good features, and should be a serious competitor for the Epson, Citizen or the NEC but clearly I cannot recommend it on the basis of my experience. However, Amstrad have told me that the head performance has been much improved, to the extent that the printer has been shown continuously dumping graphics at exhibitions. A new 15" model (LQ5000) is about to appear, with dual inputs (serial/parallel) and a speed of 298 CPS in draft mode, or 100 CPS in LQ. The price will be about £460 including VAT, and we hope to review this in due course.

Factfile

- **Amstrad 24-pin dot matrix printer. From: Amstrad dealers.**
- **Enquiries/correspondence: Amstrad plc, Brentwood House, 169 Kings Road, Brentwood, Essex. ☎ 0277 228888**

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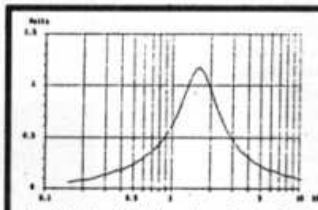

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Brian Ralph

A&B COMPUTING BACK PAGE

Has your computer given you unexpected abilities or has it given you an unforeseen affliction? This is a new field and something of a bonanza for pioneers of human potential and regrettably the cataloguers of phobias, manias and syndromes. First the bad news – prolonged exposure to computers may have made you susceptible to one or more of the following conditions.

Smugomania **– This unfortunate bahaviour pattern can continue for years where a would-be computer buyer baulks at purchasing because of a belief that whatever he buys will be superseded within days. Typical symptoms include sarcastic comments about other people's computers and mocking pity about their 'shortsighted' decision to buy now instead of later. But the smuigomaniac is a tormented soul and may snap at any second and go panic-buying for a totally unsuitable piece of junk.**

Alamoentiasis **– A condition prevalent among owners of mature computers. Having found that their computer is outdated sufferers fight an obstinate siege against the inevitable extinction of their machine. This malady is so called because of the sufferer's compulsive habit of writing letters to magazines that no longer cover their machines beginning, "Remember the Oric" or suchlike and accusing the magazine of a conspiracy against their beloved micro. Also known as 'Dragon's syndrome', it is particularly common among former sufferers of Smugomania (see above) who refuse to believe that they have made a disastrous decision after all.**

Memogluttophobia **– A morbid fear of running out of computer memory. In choosing a computer, his only yardstick is memory size; but no matter how much there is, he always wants more because he is horrified by the idea of finding that he has none left. Consequently he buys every memory add-on available until there is no room for any more. Because of his obsession he hates using his computer – every time he touches it precious memory is used up. Only occasionally can he relax and relish all that unused memory – whenever the computer's turned off. In extreme cases it has been known for sufferers to sellotape over the on-switch or even scuttle their machine to avoid using up any memory.**

But what of the good side? How many talents and skills have you picked up effortlessly by just using your computer? You may not be aware that even if you've just played a flight simulator program for a few moments you are more than capable of landing a jumbo jet. This is handy if ever the crew on your flight are struck down by food poisoning and the plane has gone into a tailspin. It seems incredible doesn't it? But recent research demonstrates that computer owners with only a couple of simulated "flying minutes" can save the lives of the passengers and crew of a pilotless airliner and usually after only one previous after only one previous attempt.

Following this example you only have to browse through your own software collection to imagine what skills you have stored away just waiting to be discovered. Researchers have found many types of this curious "play now live later" phenomenon. Think for instance if you happen to have Fruit Machine Simulator – you may actually be able to go out and play a real fruit machine. What about *Steve Davis Snooker*? It could have made you into a world class snooker player without you even knowing! But alternatively you could have just developed side effects and not be an exciting person any more. But it would not do to exaggerate these micro-diffused skills as the experts contend that in many cases they remain strictly within their specialised areas.

So overall have we gained or lost from our proximity to the home computer? There is no easy answer; indeed the experts contend that these phobias and absorbed skills can quite easily cohabit within the same person. So one day you may find yourself wrestling with the controls of the stricken 747 airliner as you anxiously ask yourself for the umpteenth time whether 512K can really be enough in this day and age?

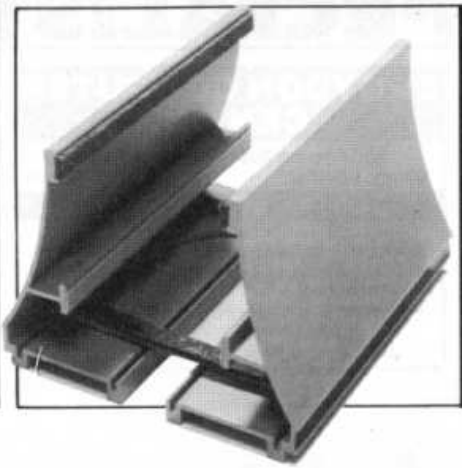
Ugly all over (and a little dumb on the side!)

World famous Anorak user and David Fahey (aka Somers) lookalike, Clive Grace off with his Mum and Dad, for an exciting days train spotting? No of course not, It's our darling Asst Ed at one of the many Press Binges that us hardened Hacks get invited to so that certain products stick in our minds. This one was for... um ... some game or other.

Hanging onto Clive is Grotbags the Witch (from Emu's World), and on the right is a world famous Editor of a well known Argus Commodore Magazine who wishes to remain anonymous. Wise move Stuart. Oops!

They should be Band

They're Hip, they're Funky (please God don't let's have a typo error there), yes it's A&B Brothers Wacky Backing Band – Hostile Grapefruit, **pictured at their sellout gig at Alberts Hall, Purley. Allow me to introduce the members. On Riddum we have Ricardo Fruitbatte demonstrating his unique "let's hit the Drum Machine with a Mike and see what happens" technique. On Keyboards Shirley "I'm so laid back I'm asleep" Knott. On Guitar we have Derek "Let's do an impression of the Leaning Tower of Pisa and impress all the girlies" Plecktrumb. And finally on backing vocals we have Mike "I taught Rick Astley everything he knows" Beecher, injecting all the raw energy of a Nana Muskouri concert.**



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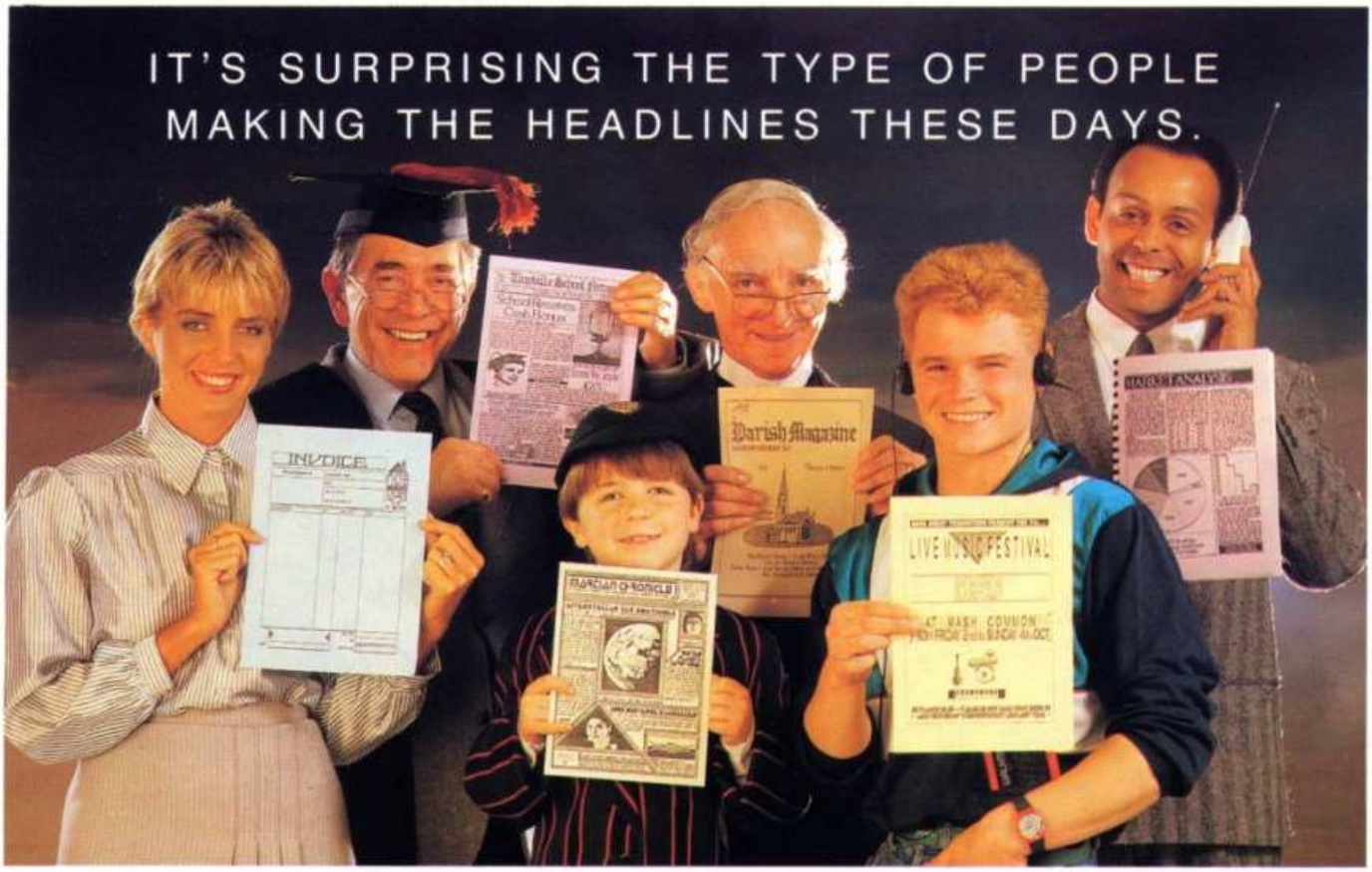

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